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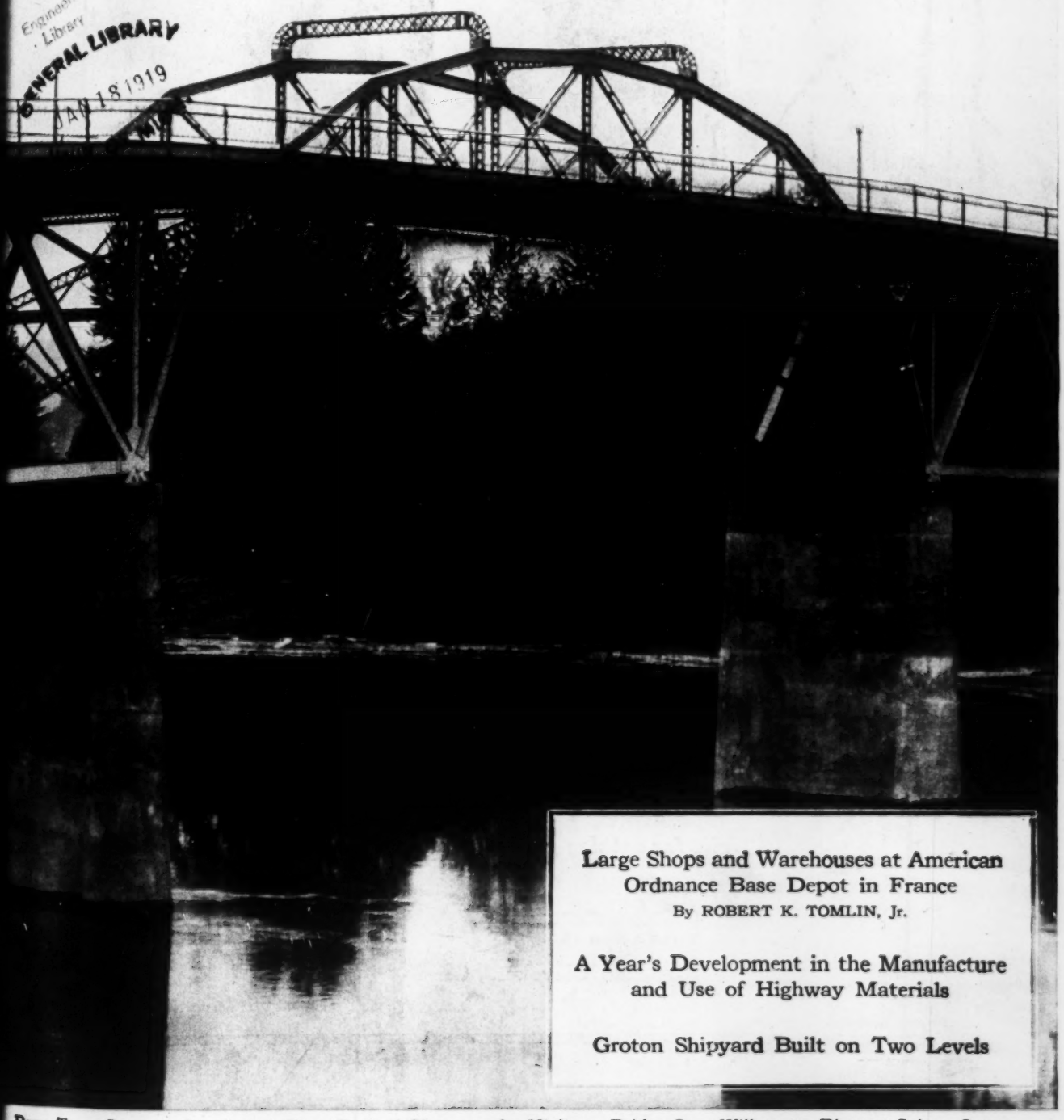
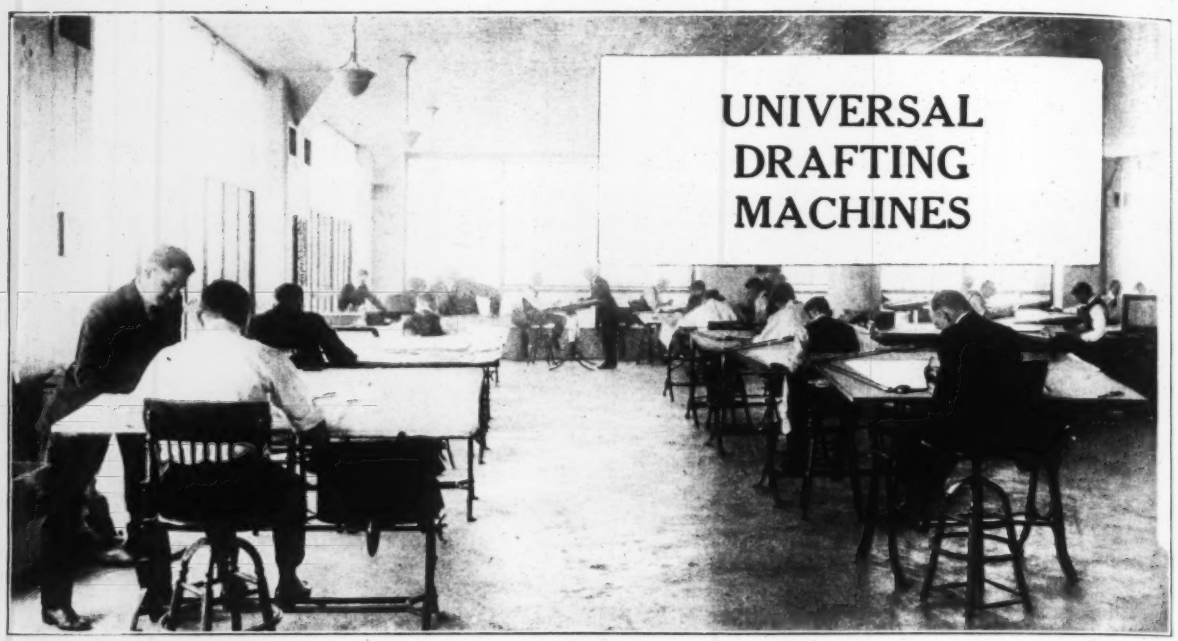


Large Shops and Warehouses at American Ordnance Base Depot in France
By ROBERT K. TOMLIN, Jr.

A Year's Development in the Manufacture and Use of Highway Materials

Groton Shipyard Built on Two Levels

Pony Truss Span on Cantilevers Gives Desired Clearance for Highway Bridge Over Willamette River at Salem, Oregon



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ENGINEERING NEWS-RECORD

A WEEKLY JOURNAL
DEVOTED TO CIVIL ENGINEERING
AND CONTRACTING

E. J. Mehren, Editor — Charles Whiting Baker, Consulting Editor

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States Should Attack Reconstruction Problems

RECONSTRUCTION problems have received so little attention at Washington, and Congress seems so unlikely to do anything adequate before adjournment, that the several states must act if danger of great injustice to soldiers and war workers and of serious industrial disturbances is to be averted. Some states have it within their power to provide work through highway and other construction. Many can aid by removing various state restrictions which prevent cities from making needed improvements. All states can and should establish or continue state agencies to deal with reconstruction problems. Such bodies should lose no time in making broad surveys of the field, with a view to determining needs and ways of meeting them and obtaining necessary legislation at the earliest possible moment.

Congress Should Unlock Water Powers

PASSAGE of the Congressional water-power bills now in conference is earnestly to be hoped for before the close of the present session. Every engineer who is familiar with the water-power situation will agree that prompt action is needed. Water-power needs to be unlocked, to conserve fuel and to furnish profitable employment to the men released from military service and munition making. The present Congress has given more attention and study to this vital matter than any previous Congress. Its work should not be lost, especially at this critical time. Even if the bill as finally reported should be more or less of a compromise and defective in many particulars, yet if, without undue sacrifice of vital interests on either side, it opened the way for even a limited development of unused water powers, it would be well worth while as a contribution to the solution of reconstruction problems and to the conservation *and utilization* of our natural resources.

Too Late Is No Better than Never

MORE and more it becomes apparent that public works are the only reservoir which will tide us over the almost inevitable unemployment crisis approaching in the construction field. That reservoir must be made ready immediately, and not delayed, as seems the prospect in most of the proposed projects. In Cleveland, for instance, with great flaunting of headlines it is announced that the mayor is now planning to furnish employment during the reconstruction period, by going right ahead with the $3,500,000 East Side filtration plant. So far the announcement seems hopeful, but one reads farther and sees that it is expected that ground will be broken "the latter part of this year." So far as helping present needs is concerned, such a plan is about as useful as would be a scheme for huge landing places for the transatlantic airplanes which the optimists tell us will be flocking across the ocean within the decade.

Taking State Highway Routes Out of Politics

VARIOUS plans have been devised to keep the designation of the routes to be followed by state trunk highways out of politics, but generally without success. Log-rolling to bring the improvements to locations where they will do the most good to the particular crowd of politicians in power has always been a disorganizing factor, and one which has put peculiar "kinks" in many systems. To eliminate this troublesome interference, the highway officials of Minnesota propose to map out a system and submit the map to vote of the people, as a part of a constitutional amendment (noted in *Engineering News-Record* of Dec. 26, p. 1199) necessary to enable the state to enter upon highway construction. In laying out the roads, tentatively, they have been proportioned to the various parts of the state according to assessed valuation and population, and, if approved, each section will know just what roads it is entitled to. Such a plan has the advantage of fixedness in any event, and if any "fixing" is done in the original layout, the people will be in a position to see the results before voting. The object of the plan—freeing highway routes from log-rolling—is most commendable, but it is a pity if there is no way of doing it short of making the proposed highway routes a part of the state constitution. Such documents should be confined to fundamental principles and not lumbered up with administrative details.

A Daring Adventure In Municipal Ownership

SEATTLE is making a daring adventure in municipal ownership. As noted on p. 163, the city authorities have taken action to buy the local street-railway system. British and some continental European cities set the example long ago. San Francisco has municipalized an important street railway line or two, and Seattle already has a short line of its own. New York, Boston and Philadelphia have put millions into subway construction for private operation, and Cincinnati launched a similar project before we entered the war. Seattle, if it goes forward as rapidly as is expected, will be the

pioneer American city of considerable size to own and operate its entire street-railway system. Whether the present difficulties besetting many of our privately owned street-railway systems will lead to an early extension of municipal ownership is an interesting question. At this critical juncture in local transportation, perhaps it is well that some American city should make a trial of complete municipal street-railway service. Seattle has volunteered.

Philadelphia Again Pays Heavy Penalty

AMONG the good features proposed for insertion in a new charter for Philadelphia under consideration by a voluntary charter committee is one that would authorize long-term contracts for some city services now restricted to yearly contracts. The need for such a reform as to garbage disposal has been pointed out again and again by *Engineering News-Record* and its predecessors. It was recently illustrated anew by a contract award for garbage disposal in 1919 at an advance of $123,636 over the 1918 contract. Earlier last year a bid at a reduced price was received, but for reasons presumably connected with the one-year contract system it became necessary to readvertise the contract twice. As was to be expected, with a new contract beginning Jan. 1, and requiring an extensive plant, there was no competition. The legislature has been asked in vain to authorize long-term garbage contracts for Philadelphia. It gives heed to the interests of contractors and politicians instead of to the pocket books of the citizens of Philadelphia. Possibly this evil, in common with others with which Philadelphia is burdened, may be remedied by a new charter. Unquestionably, they might be if the people would prove by an aroused united effort that Philadelphia is no longer "corrupt and contented." What are the engineers of Philadelphia doing about it?

Look Well to Choice of Camp Cook and Save Money

FOOD waste is characteristic of construction camps, as it is shown by Captain Tharaldsen on p. 146 to be characteristic of lumber camps. Perhaps waste is not so large in construction camps, but the causes are the same. The remedies outlined in the article apply to construction as well as to lumber camps. Camp messes in general fail more because of poor cooks than because of limited variety and poor quality of supplies. This fact makes of prime importance the task of selecting a camp cook. Captain Tharaldsen's remarks on this point deserve emphasis. The position of camp cook is not a menial one which any "pot slinger" can fill even in a small camp. When several hundred men must be kept fed and satisfied, it is a position which only a man having knowledge of foods and menus, and catering generally, can fill and keep the men contented and the costs moderate. No construction employee should be hired with greater care to determine his skill and responsibility than the camp cook. Few workmen can, because of personal inefficiency, directly and indirectly cost the job so much money as its cook. With the higher standards of catering set by war construction as examples, there will be more need than ever for the contractor to look well to the quality of his camp mess.

Motor Trucks Needed To Supplement Not Compete With Railways

THE radical changes in manufacturing industries resulting from the suspension of hostilities and the cancellation of munition contracts are paralleled by the changes in the transportation field. The competition between the railway and the motor truck is entering on a new phase. The motor truck has been an invaluable aid in the munitions industry, especially during railway congestion, because it could give prompt deliveries. Cost of service has been a minor consideration.

That condition has passed. The manufacturers and merchants are looking after their freight bills as sharply as they do to their purchases of goods; and to hold its place the motor truck must show as low a cost, all things considered, as the railway.

During the traffic congestion resulting from the war the railway managers have rather welcomed the diversion of business to motor-truck lines. With the relief of congestion the railways, naturally and properly, are seeking to regain their business, for profits in railway transportation depend directly on the volume of traffic, until the point of congestion and delay is reached.

Certain railway managers are making a careful study of truck transport costs in order to determine the field in which they can expect to regain business. Realizing that one chief advantage of the motor-truck service is prompt delivery, railway managers are making plans for a more rapid and systematic handling of small merchandise shipments over short-distance routes.

As several contributors have pointed out in the columns of this journal recently, the railway and the motor truck ought to supplement each other. Every engineer will heartily approve the recent declaration of Director General McAdoo, "Upon the efficiency of the transportation machine in America depends in great measure the future prosperity of the nation." This efficiency can only be secured by furthering the use of whatever type of transportation that can render the service desired at the lowest cost.

There is an enormous field for the motor truck in reducing the present heavy cost of terminal hauling—using that term in its broadest sense to include short-haul business between cities. It ought to be more generally understood that this is where the need and the opportunity for the motor truck lie and not in competing with the railways for traffic over long-distance routes.

When freight has been loaded into a railway car, made up in a train, and started on its journey, the railway can haul it at a cost per ton-mile which is often not 2% of the cost of hauling by motor truck. The average cost per ton-mile for all freight moved over the Pennsylvania R.R. in the year which ended June 30, 1916, was only 0.43c. This includes, of course, all the expense of handing in railway terminals as well as hauling over the road. Even on railways of very light traffic, the cost of hauling freight over the road seldom exceeds 2c. or 3c. per ton-mile. In contrast with this, the cost of hauling freight by motor truck, even over good roads, is seldom less than 15c. per ton-mile, and often exceeds 25c. This does not include, either, the interest, maintenance and depreciation charge on the road over which the truck runs.

The advantage of the motor truck over the railway lies in its ability to transport goods from the original to the final destination without rehandling. This eliminates the terminal expenses of the shipper and receiver as well as those borne by the railroad itself. These terminal costs on most merchandise shipments are several times the cost of hauling by rail, even when the distance is considerable. It is not at all uncommon to have the cartage charge on a freight shipment at destination equal the railway freight charge on a haul of several hundred miles. The larger the city, the larger, as a rule, are the costs of the terminal handling, both to the railway and to the shipper. The repeated rehandling of goods necessarily is, of course, a large element in these terminal costs, and on certain classes of goods the loss and breakage likely to occur in such rehandling counts very heavily in favor of the motor truck.

This whole matter is not one that interests merely the builders and operators of motor trucks and the railways. Its vital relation to the public welfare is obvious from the quotation from Director General McAdoo, already given. It is not possible to reduce much farther the cost of transportation by railway over long distances, but there are great opportunities for reducing the costs of movement at both ends. The problem here, furthermore, is as much a problem of organization as it is of the proper use of both railway and the motor truck to accomplish the work to which each is best adapted.

Is Interstate Communication Local?

ONLY a week or two ago the War Department reported against giving Federal aid to the construction of a highway tunnel under the Hudson River at New York, on the ground that such an improvement would serve local traffic and benefit local interests. Within the past few days, however, the Government has intervened in a boatmen's strike which stopped communication across the river, and thereby it has acknowledged in unmistakable manner the national importance of this communication.

If the port of New York—physically a unit, but cut in two by the New Jersey-New York state line as regards construction, planning and administration—concerns the nation sufficiently that the Federal Government may take a hand in its intercommunication problems, what shall be said of other places where there is interstate communication? Hitherto the Government has hesitated to approach problems of communication and transportation that are localized at state lines, though these are preëminently problems of interstate commerce. But what has been learned in the past two years about the urgency of transportation questions suggests that the time has come for a change of attitude.

Consider, as an example, the case of the Hudson River, which for 150 miles splits the country in two, without a single road connection and but one railway crossing. In this stretch the Federal Government has spent millions of dollars for facilitating traffic along the river, but not one dollar to help carry traffic *across*. No reason exists for this discrimination except policy founded on an ancient tradition: That rivers are proper subjects for Government appropriations, while bridges and tunnels are not. Shall we continue to let tradition control the allotment of vast sums of public money to works of construction?

Every important river forming a state boundary shows the same conditions existing. As in the case of the Hudson, each instance gives proof that interstate communication is important, and that it has become sunk in general neglect. Local interest, as experience has shown time and again, furnishes no incentive for dealing with the subject broadly, to take care of the whole country's interests.

The national concern in the question, then, is obvious. Interstate communciation is not a local issue. To secure the best adjustment of national, state and local interests in a specific case will not always be an easy problem, but the adjustment will be quite impossible so long as responsible Government departments continue to be guided by tradition rather than by present-day need.

Are Engineering Educators Seizing Their Greatest Opportunity?

ONE of the illuminating statements in the symposium from the deans of various engineering schools upon the effects of their experience with the Students' Army Training Corps (see *Engineering News-Record* of Jan. 2, p. 41, and p. 138 of this issue) is that by Dean Snow, who quotes the popular phrase, "We do not know where we are going, but we are on our way." A review of the replies in answer to the question on future needs and opportunities in engineering education and how they can be met will disclose a discouraging lack of definite ideas, in spite of the fact that the greatest success will come to those educators who best foretell the demands of the future. Do American educators need a reawakening to develop teacher-leaders in applied science? Is it too much to expect a combination of great power of achievement, such as America has shown in the war, with leadership in science? Can we not insist upon a degree of excellence in our schools and colleges such as we have just demanded from industry during the war? Is H. G. Wells right in calling English and American education a "loafer education" as compared with German depth and thoroughness? Have we in the past failed to develop power of sustained mental effort in the graduates of our engineering colleges?

These questions are now receiving the serious consideration of engineering educators, many of whom have been profoundly influenced by their recent experience. For while many colleges are returning to pre-war courses, yet individuals and committees are discussing proposed changes, and studying Dr. Mann's report with its "suggested solutions." Few have made or announced definite changes—some give an impression of being self-satisfied. The majority favor fewer highly specialized courses and a more thorough training in the fundamental core sciences. There is a general agreement that one result of the experience will be a peace issues course, similar in character to the war issues course given in all the S. A. T. C. colleges, to demonstrate the meaning of engineering work in the life of the world. One of the big lessons of the war is the possibility of arousing exceptional effort through the power of a real incentive.

The war experience suggests a solution of the problem of how to provide bread-and-butter training and at the same time meet the need for broadly educated men of limitless possibilities. This solution is a combination course coördinating general with highly specialized courses, using both the spur of discipline and the drawing power of incentive. The latter may be developed by showing the worth of academic effort, by tying it up to actual engineering work. In this combination, which in favorable localities may mean coöperative courses, such as developed by Dean Schneider at Cincinnati, the weakness of both extremes will be overcome—the superficiality and "bluff-it-through" attitude of graduates of general courses on the one hand and the narrow, materialistic results of overspecialization on the other.

The serious question of time limit in a four-year course should be met by using more of the synopsis method and leading the student to read and investigate for himself. This would develop originality and initiative, the necessity for which has been shown, by our war experience, to be so essential. Fewer lectures, refusal to permit teacher-specialists to dominate other departments, new tests for measuring acquired knowledge which will combine the objective tests proposed by Dr. Mann with the usual examination methods, would all tend in the right direction.

Perhaps the greatest need is for teachers with broad vision and practical experience in engineering life. Administrators of technical schools must realize that no price is too great to pay for educators capable of lifting the profession, through their influence on its young men, to new heights of accomplishment.

Government Directors for Railway Corporations

IN THE illuminating discussion of the question of what to do with the railways, by L. C. Fritch, in *Engineering News-Record* of Jan. 2, p. 18, one suggestion in particular is so important and valuable that it ought to be incorporated in any plan involving the return of the railways to company control.

Mr. Fritch urges that in addition to supervision by the Interstate Commerce Commission there should be on the board of directors of each railway company men appointed by the Government to represent the interests of the public. He says: "The policy of selecting able representative business men to act for the Government in such capacity would result in business management of the railways in the interests of the public, and would have a wholesome effect in railway administration."

This, we believe, is one of the most constructive and fruitful suggestions which has been made in the public discussion of the subject. Everyone agrees that there must be established a firm control over railway operations in the public interest, if they are to be returned to the companies. But all regulation by a commission, however constituted, is regulation from outside. What is needed in the public interest, and in many cases in the interest of railway security holders as well, is regulation from inside.

At any previous time it would probably have been impossible to have carried out such a reform successfully, because of the antagonistic attitude which would have been assumed toward such Government regulation. Railway managers and financiers, however, are viewing things through very different eyes from those they used half a dozen years ago, and Government-appointed directors of the right type would not have the uphill fight that would have been their portion a few years ago.

We say, "Government directors of the right type." Of course, if the authority to name directors to represent the public were made use of by the Government to take care of "lame duck" Congressmen and other needy politicians, or to put bureaucratic hacks in a position to exercise authority, the Government directors would be figureheads or worse.

Real and Unreal Progress in Steel Working Stresses

IF THE majority of the structural engineering profession of the country were in accord with the ultra-conservative limitation of column working stresses to 12,000 lb. base, as recommended by the Column Committee of the American Society of Civil Engineers a year ago and now reflected in a few new specifications, there would be reason to fear that engineering judgment is at fault. Structures proportioned for much higher stresses have given satisfactory service for many years, without the least symptom of trouble from excessive column stress. In view of this service efficiency, there is no solid ground to support the claim that steel columns loaded above 12,000 lb. are unsafe; on the contrary, the facts of experience must be taken to prove that a 12,000-lb. limitation will mean a waste of material.

There has been enough criticism of the committee's recommendation to make it probable that practice will be slow to accept it. Individuality of thought is a necessary factor in bridge engineering; committees, however, are often dominated by conservatism or even timidity. It is natural, then, that engineers should protest—as does Dr. Waddell in this issue—against any straitjacketing of structural judgment by the result of such tendencies.

Further tests on columns are surely desirable. But Dr. Waddell suggests a new kind of testing, using a truss or a bridge as a testing machine. The method has attractive aspects, but do we need it? Will it aid progress toward safety and full utilization of material?

The tests conducted for the Civil Engineers' committee, though laid out on a narrow plan and leaving many practical conditions unrepresented, yet produced data that establish a satisfactory basis for judgment on the strength of steel columns. Additional tests, then, should be precise experiments on specific questions of detail. To complicate such tests by introducing the elusive and erratic influence of truss distortions is not likely to meet this requirement.

However, if further testing of heavy members is to be initiated, tension members offer the field of greatest promise. It is true we have ample data on eye-bars. On the other hand, less is known about the strength of the large riveted chords and diagonals of modern bridges than about any type of compression member. It may well be said, therefore, that tensile working stresses are involved in greater uncertainty than column stresses.

Despite this fact, a tendency is distinctly observable toward increase in tensile unit stresses even while—since the report of the Column Committee—the compressive units are being pared down. It is remarkable that this should be the case, in the absence of test knowledge. Manifestly, those who propose to increase stresses aim in the direction of true progress, by way of safety and economy. But we think it may be fairly objected that they secure these objects in divided form—safety in the compression members, economy in the tension members. Is it not necessary, at this stage, to inquire whether test data and sound judgment warrant a raising of tensile stresses to eighteen or twenty thousand pounds and a lowering of column stresses to twelve?

While refinement of analysis and design has been helping us on toward maximum utilization of material, we have adhered to the large margins of ignorance that were established in the early days of the structural art. An increase of working stresses, then, is needed, and if all signs do not fail such increase is sure to come about—at least for those structures which do not involve the perplexing uncertainties of change of railway loading. These stress increases, however, will be based on dependable knowledge of strength, test knowledge, or they cannot be permanent steps of progress. Change such as represented by an indiscriminate increase in the tensile units, while we know nothing whatever concerning the strength of large riveted tension members, is not entitled to rank as true progress.

Electric Drive for Warships

IN THE great superdreadnought "New Mexico," as our readers are well aware, the United States is possessed of the first electrically driven battleship in the world. True enough, we have already had a "trial horse" in the collier "Jupiter," which proved a rather conspicuous success, but the step from a collier to a fighting ship of the highest class is a considerable one, and it is gratifying to know that it has been most successfully taken.

There is nothing mysterious about the general principle involved—that of a high-speed and light-weight generating set furnishing current to variable-speed driving motors. To all intents and purposes, the electrical part of the equipment is a very efficient variable-speed reducing gear. The basic idea behind the electrically driven ship was the intent to take advantage of the great simplicity, compactness, convenience and weight efficiency of the steam turbine, so as to adapt it to marine purposes. No one would have had the least desire to use electrical drive in connection with reciprocating engines.

The steam turbine, of course, in its present stage of development, possesses the qualities just mentioned in an extraordinary degree, and the one thing which stands against it is that these qualities are virtually dependent on the extremely high rotative speed necessary for efficient design, a speed at least ten times greater than can be advantageously used on the propellers of a large ship. To utilize the steam turbine in marine practice implied either an enormous increase in the propeller speed or a great reduction between the turbine and the screw. The former alternative implies, owing to increased friction and slip, a very great loss in the propeller efficiency, so great that it would outweigh, several times over, any conceivable gain by the use of the steam turbine instead of the reciprocating engine. But at its best the steam turbine has such remarkable efficiency from the thermal standpoint that one can readily afford the losses in almost any sort of well-designed reducing gear. As an example of what a turbine can do, it is only necessary to quote the guaranteed performance of a turbine recently installed for land service, which at 14,000-kw. load brought the steam consumption down to 10.45 lb. per kilowatt-hour, equivalent to 0.78 lb. per brake horsepower-hour. Obviously, at this low steam consumption one could well afford considerable loss in a reduction gear while still retaining a fuel consumption of about one pound of coal per horsepower-hour. On the other hand, the losses in trying to use a propeller at the turbine speed would more than nullify the advantages of a turbine.

As between the mechanical gear and the electrical gear as a means of speed reduction, the advantage of cost and weight lies with the former, but that of speed control, subdivision of power in the propellers, and general flexibility, enormously with the latter. In the mechanical sense, too, the electric drive is almost frictionless, the losses being thermal instead of mechanical, and so not expressible in terms of wear. So, whatever success may have been attained with gearing in relatively simple cases for naval use, the electrical gear was a logical recourse. One need not go here into details of the equipment of the "New Mexico," which will undoubtedly be very fully described, now that the war is at its close, in the technical journals specializing in such matters. In brief, she is equipped with two 11,000-kw. turbo-generators which furnish the power to four 7000-hp. driving motors. As the induction motor is essentially a constant-speed machine, the intermediate and lower speeds are obtained by varying the turbine speed, which can be done within moderate limits without too serious effect upon its efficiency. For low speeds one generating set can handle any or all of the motors that may be necessary, and either set can be put upon any motor connection that is necessary.

This arrangement gives a beautifully efficient and flexible drive, and its advantages for naval use are of momentous importance, perhaps not yet fully realized. In fact, it is probably not too much to say that the electric equipment of the "New Mexico" opens a new era in naval architecture. The dimensions of the turbo-generators and of motors are such that they can be kept low in the ship, exceptionally well protected beneath the water line and armor. The motors, too, can be located so as to maintain the best structural relation to the propellers which they drive.

The United States stands committed already to six battleships and five battle-cruisers equipped with electrical drive, and the success of the "New Mexico" is prophecy of the great future that lies before the system. Nor is it likely to be confined to ships of the battle line, for its advantages would be especially valuable in the large, fast cruisers which form the everyday working force of a well ordered navy, ships uniting great radius of action, very economical cruising speed for their long swings about the Seven Seas, and prodigious power when it is necessary to drive them.

Huge Steel Buildings at Ordnance Base Depot in France

Project Includes Both Shops and Warehouses—All Material Supplied from United States—Ten-Mile Transmission Line Built to Supply Electric Power for Machine-Tool Operation

All photographs by "Engineering News-Record"

By Robert K. Tomlin, Jr.
War Correspondent of "Engineering News-Record"

This article was written last summer and delayed in transmission. It is published at this time just as written by Mr. Tomlin, because of the great interest in the work of our engineers in France.—Editor.

INTO the construction and equipment of the main Ordnance Base Depot for the American Expeditionary Forces is entering about 60,000 tons of material, practically all of it shipped from the United States. Covering a site of many acres, the 10 big steel structures, now almost completed, represent one of the largest building projects undertaken by United States forces in France. Certainly, it is the largest project involving the exclusive use of structural steel; yet, in spite of the diversity in size and character of the several buildings, standardization has been carried to such a point in the designs prepared for the Ordnance Department by the firm of Stone & Webster that only 148 different kinds of pieces are required for the entire work, this number including not merely main steel members, such as columns, rafters and purlins, but also such small accessories as anchor-bolts, tie-rods, clips and angles.

The buildings already erected (Aug. 15) comprise the following: Two gun-shops, each 245 x 600 ft. in plan; one reamer shop, 182 x 240 ft.; two warehouses, each 240 x 500 ft.; one carriage machine shop, 227 x 500 ft.; one carriage assembly shop, 240 x 500 ft.; one woodworking shop, 200 x 320 ft.; one forge and foundry shop, 160 x 245 ft.; one substation, 40 x 60 ft. This program alone represents steel-frame buildings covering a ground area of 917,000 sq.ft. As future possibilities there are, in addition, two tractor shops, each 245 x 600 ft.; two warehouses, each 240 x 500 ft., duplicating those already built; and a small-arms shop 240 x 500 feet.

All Material Shipped from America—After an investigation of the material markets of France more than a year ago, it was decided to send over from the United States everything needed for building and fitting out the ordnance shops and warehouses. This meant a tremendous amount of advance planning, for provision had to be made not merely for the structural-steel frames, roofing and glazing, but also for a big schedule of machine tools, cranes, electric-lighting fixtures, power equipment and construction plant. The job had to be figured down to the smallest detail, purchases made in America and shipping schedules laid out.

The unusual character of the work, in which the questions of a 3000-mile transatlantic trip for everything entering into the construction, and the probable use of labor entirely unfamiliar with steel erection, were the controlling features, made the preliminaries a subject of prime importance. To have started work in France and then to have discovered that something had been forgotten would have meant not a delay of a few weeks waiting for its arrival, but a setback of months, for material could not be delivered quickly from the United States to France under conditions of shipping existing early in 1918. Foresight in ordering materials has been a big factor in aiding progress.

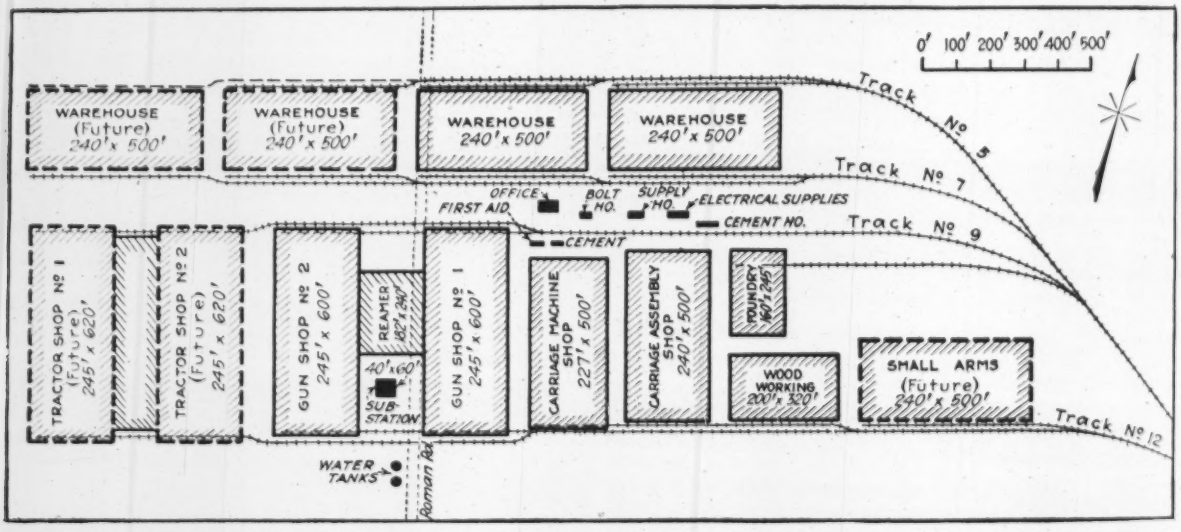


FIG. 1. GROUND PLAN OF THE ORDNANCE BASE DEPOT IN FRANCE SHOWING PRESENT BUILDINGS (JUNE 1918) IN SOLID LINES, AND CONTEMPLATED ADDITIONS IN DOTTED LINES

FIG. 2. DETAIL OF COLUMN FOOTINGS, SHOWING CORRUGATED IRON FORMS FOR CONCRETE

History of the Project—The history of the Ordnance Base Depot in France dates back more than a year, when the contract for the design, purchase of materials, and supervision of construction was awarded to the Stone & Webster organization. The project as originally laid out was described in *Engineering News-Record* of Jan. 3, 1918, p. 13. Many changes, both in the actual layout and the handling of the work, have taken place since those days. It is worth while to present a brief historical outline, for without it no true conception of the project and the working conditions is possible.

Unlike most of the Army engineering work in France, the Ordnance Base Depot has involved the participation of a civilian organization, not only in the design but also in the handling of materials and the supervision of construction. This resulted in the creation of certain special conditions which had their influence on the conduct of operations in the field. To begin with, a civilian organization in the American Army zone of France is not in a position to order things done by military units. There must always be some intermediary. This applies not merely to the actual handling of labor, but to another matter equally as important—transportation of materials. The site of the job is quite a distance from the nearest base port, and, in fact, from the nearest railway station. When railway cars or motor trucks are needed, arrangements for them cannot be made directly; everything must go through military channels.

The status of the civilian representatives was, therefore, somewhat anomalous. As events have turned out, their duties have been largely supervisory. Instead of officially directing the job, and being responsible for its progress, the civilian engineers and superintendents have acted as consultants, rather, giving advice as to the conduct of the work and placing their construction experience at the disposal of such officers as cared to avail themselves of it.

Labor Scarce—One of the earliest difficulties encountered was the matter of labor. The intention was to have the Ordnance Base Depot built by the enlisted personnel of the Ordnance Department, with the Stone & Webster representatives acting as superintendents. The vanguard of the Stone & Webster forces had arrived in France in September, and about the middle of October the Ordnance Department officers who were to have immediate supervision of the project arrived. After some time was spent in examining possible sites for the plant, a definite location was fixed late in October, 1917, and steps were taken to obtain the land from the French. One of the first jobs to be done was the construction of a railroad siding connecting the site with the nearest French railroad line, for material was beginning to arrive in France and means were needed to deliver it to its destination. As all sidings, railroads, camps and other accessories for this project had been assigned to the Army engineer troops for construction, a detachment of engineers was placed on this work and the siding was put in the latter part of January, 1918.

While this was the first step in actual progress, other difficulties were to follow. There were no unloading facilities at the site in those early days and labor was scarce, as a detachment of ordnance troops scheduled to arrive had not reached the job in the numbers expected. Meanwhile, the engineer troops which had put in the railway track began to construct barracks for the working force, and finally began the actual job of putting up the steel buildings for the base depot. In the meantime a detachment of 600 Chinese had appeared on the scene and they were set to work unloading cars and distributing material.

As time went on, however, material still continued to arrive, the labor force began to build up, and the civilian representatives continued in an advisory capacity, assisting in the layout of the work, the routing

FIG. 3. INTERIORS OF STEEL STRUCTURES ARE PAINTED WITH COMPESSED AIR SPRAYS

of materials and the supervision of the steel erection. Ordnance and engineer units in varying numbers came and went, and by the middle of April about 1200 men were on the job. Since then, the force has carried between 1200 and 3000, and on July 1 it numbered about 2500.

The labor force, however, was never constant. In the case of detachments, these would come and go, or, even if they remained, details would often be removed from construction operations and assigned to other duties. The conditions with respect to these troops

are best expressed by one of the officers who, in discussing the difficulties due to the lack of a permanent working force, said that many of the detachments he received "merely filtered through the job." It became necessary, therefore, to train successive batches of men as they arrived, and to lose the benefit of this training

FIG. 4. CONCRETE FOR MACHINE TOOL FOUNDATIONS CARRIED IN METAL-BODIED WHEELBARROWS

when they were removed. The engineer troops, however, remained, and their number was greatly increased by the addition of other units.

Between the commanding officer of the engineers and the members of the Stone & Webster organization still on the job there has developed a spirit of cordial coöperation. In fact, during my visit to his headquarters, this engineer officer said to me: "Too much cannot be said for the help which has been rendered by the civilian superintendents and engineers. We are all glad that we have had them here on the job."

Additional engineer battalions arrived at the Ordnance Base Depot site about Mar. 1. In reply to my question as to what he had available for commencing work, Major F—, commanding, replied, "Nothing but snow." He started his men on excavations for the column footings of the big steel buildings and assigned a labor crew of about 500 Chinese to unloading material which was beginning to arrive in large quantities on the newly built sidings connecting with the double-track French railroad.

In the early days of this work everything had to be unloaded by hand, as no locomotive cranes had arrived. It was no easy job to remove some of the steel members from the short French railroad cars, on account of the limited clearance at the ends. With the material out of the cars the problem was by no means solved, because at this time of the year, with the frost leaving the ground, the site was a veritable mud sea—so soft, in fact, that the two-wheel pick-up carts used later for transporting steel columns, rafters and purlins sank in so deep that they could not be moved. At this time all of the steel-work was transported from railway truck to building site in slings carried by Chinese.

There are in the new ordnance depot two general types of building, the warehouse and the shop. The warehouse structures have 10-in. I-section columns spaced 20 ft. on centers, all of the columns being of one length and therefore interchangeable. The roof slope is obtained by varying the elevations of the concrete footings on which the columns rest. The steel frames of the warehouse buildings are sheathed with plain, corrugated, galvanized-iron sheets. A single warehouse structure 240 ft. wide and 500 ft. long involves the erection of 410 tons of steel. Including other accessories, such as corrugated siding, roofing, doors and glass for windows, the total weight of the

FIG. 5. PACKING CASES SUPPLIED ALL THE WOOD FOR FORMS OF MACHINE-TOOL FOUNDATIONS

material entering into a warehouse of the dimensions given above is about 700 tons.

While the shop buildings are of the same general type as the warehouses, they differ in certain important details. In the first place, structures such as the big gun-shops will be equipped with traveling cranes in every bay. The column spacing for the shop buildings is 35 ft., as compared with 20 ft. for the warehouses. The columns themselves are heavier, built-up members, in order to carry the crane loads. In the case of the shops, the roof slopes are not obtained by varying the elevations of the column footings, but rather by setting at the proper elevations, by means of a flexible splice,

FIG. 6. CRANE WHICH HANDLES EXCAVATION FOR GUN-SHRINKING PIT

light extensions of the main columns. In other words, the heavy columns are bored with holes for some distance at their tops, and the lighter extension members supporting the roof are bolted to them at the the elevation desired.

In the matter of the concrete footings for the columns there is also a difference between the warehouse and the shop structure. In both cases the footings are cylindrical. A plain footing serves for the warehouse, inasmuch as the columns carry only the dead

loads of the roof, but a spread footing is used under the shop columns which support the craneways.

In one other detail also the two types of buildings differ. Warmth in the completed warehouse structures is not a matter of any great importance, and the sheathing, therefore, is of plain, corrugated sheets, galvanized. In the shop structures, however, the force of men will be at work winter and summer, and to conserve heat the sheathing adopted for the sides is asbestos-protected metal.

As indicated in the first paragraph of this article, every effort has been made in the design to standardize the lengths and cross-sections of members and to reduce to the minimum the number of all the different kinds of pieces. All connections are bolted and only two sizes of bolts, ⅞-in. and ¾-in., are employed. The fact that all of the huge structures indicated by solid black lines in Fig. 1 have been erected by labor a large percentage of which had absolutely no previous experience on steel-work is a tribute not only to the engineers who supervised the erection, but also to the men who designed the structures which could be thus handled in the field.

One detail of the spread footings for the shop building columns should be noted. Practically no wood was available for concrete forms, and it will be seen from Fig. 2 that corrugated sheets intended for the siding of the buildings have been bent and employed for concrete forms.

In the early days of the steel erection, which was started Mar. 28, no plant was available, and gin-poles were rigged and used for hoisting the roof members into place. Later, however, auto-cranes of the type shown in Fig. 10 and hoisting engines (see Fig. 9) arrived and greatly expedited steel-erection progress. One rafter was always bolted to a column on the ground, and the two members were raised to place simultaneously.

The original plans contemplated the use of a thin cement layer on top of the corrugated roofing, but on account of the scarcity of cement and sand this feature had to be eliminated. The roofing actually in place consists of a full mop of pitch, two plies of roofing felt and tar, and one ply of finish roofing, the latter being laid in strips with a lap of 6 in. On the buildings thus far erected for the Ordnance Base Depot the roofing item alone involves the covering of an area of nearly 1,000,000 square feet.

The interior of the buildings is painted by sprays (Fig. 3), supplied with air from portable compressors, gasoline-driven. These machines also supplied air for reaming and drilling tools used in connection with the steel erection and electric wiring.

During my visit to the job a large percentage of the glazing had been finished on the shop buildings. Wire-glass is employed for the monitors, while the side-wall sash is fitted with ribbed factory glass. Like everything else entering into the work, the wire-glass was supplied from America. On such a long trip and in the reloading in France, a certain amount of rough handling was inevitable, but even those panels which are cracked are entirely serviceable, as the wire reinforcing holds the plate rigid. Sheets of glass with cracks radiating across their surfaces like spider-webs are set up in the monitors and are performing efficient service. The use of wire-glass has effected a substantial item of saving, because it has rendered unnecessary the replacement of breakage. This is not the case with the plain ribbed glass. At a time when the demand for glass in France has been increased by the bombing and long-range bombardment of cities by German airplanes and guns, it has been possible to use at the Ordnance Base practically all of the wired glazing which we brought over here, rather than go into the French market for it.

The machine tools with which the shops will be equipped include practically everything up to huge gun-barrel lathes 60 ft. long. There is demanded, therefore, a very sizeable yardage of concrete in the foundations for this equipment. The excavation is made by pick and shovel, and for the concrete a number of portable ½-yd. mixers, such as those shown in Figs. 4 and 5, are employed. The delivery of cement and aggregate to the machines and the transporting of the concrete to the forms are handled by metal-body wheelbarrows, of which there are a great number on the job. They are employed not only for the delivery of concrete to machine-tool foundations (Fig. 5) and column footings, but also for distributing the earth fill for the floors.

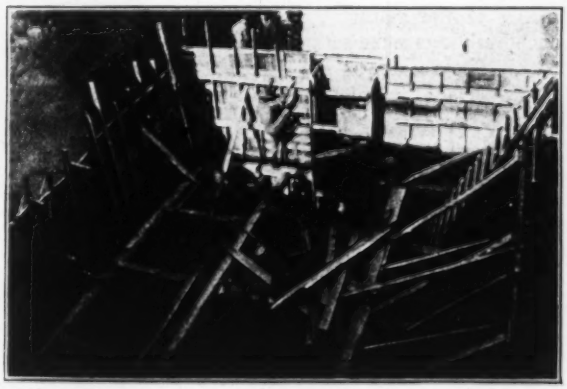


FIG. 7. WOODEN FORMS IN PLACE FOR CONCRETE LINING OF GUN-SHRINKING PIT

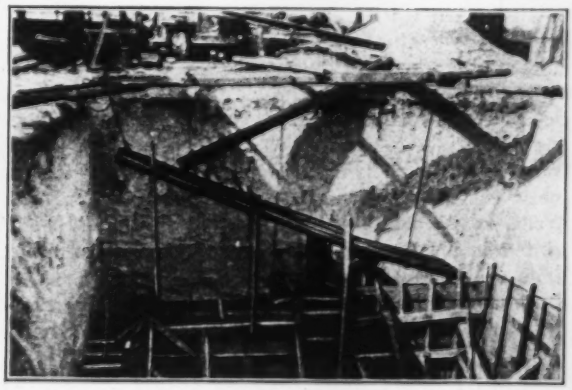


FIG. 8. CORRUGATED IRON SHEETS FORM INCLINED CHUTES FOR LINING GUN-SHRINKING PIT

Wood is at a premium on the Ordnance Base job, and the sight of packing-cases broken up and used for concrete forms is such an old one in France now as hardly to attract attention. Practically all of the forms for the machine-tool beds are made of packing-case lumber. Another place in which this lumber is serving is in the gun-shrinking pit at one end of the gun-shop. Here a rectangular excavation 20 x 35 ft. in plan and 25 ft. deep was taken out with the aid of a clamshell bucket and a crane, as shown in Fig. 6. This pit is being lined with concrete, mixed in a paving mixer. An interesting detail of the work of placing the concrete is the improvised inclined chutes shown in Fig. 8. These are merely the regular corrugated sheets used for the siding of the warehouses, and bent into the form of a trough.

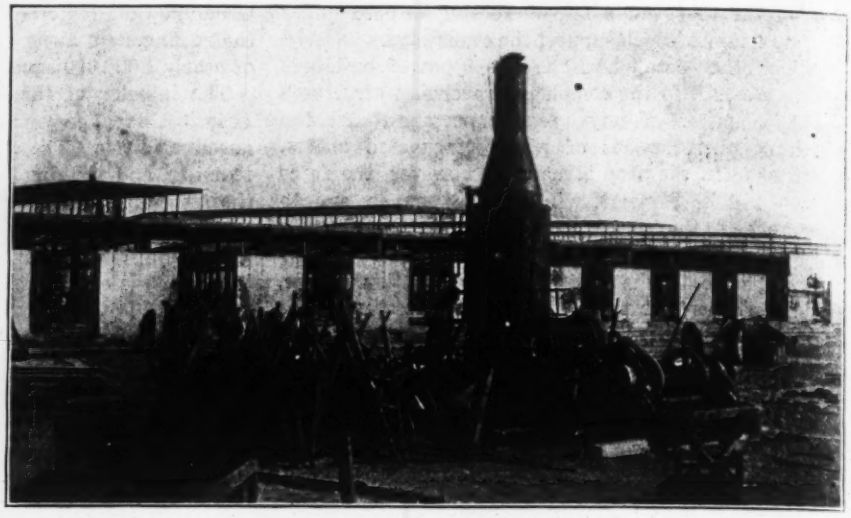


FIG. 9. IN BACKGROUND, STEEL WAREHOUSE STRUCTURE PARTIALLY SHEATHED; IN FOREGROUND, HOISTING ENGINE USED IN STEEL ERECTION

The patchwork character of the framework in the shrinking-pit, due to the scarcity of lumber, is also plainly indicated in Fig. 7. The concreting of the floor of the pit was rendered difficult by a flow of underground water amounting to 600 gal. per minute. Pumps had to be installed before the concreting work could proceed. While on the subject of concreting, it is well to mention the difficulty of obtaining cement, sand and coarse aggregate. One of the superintendents told me that the job has been out of concreting materials for 10 days at a time.

Shipping Details Systematized—With the tremendous number of crates reaching France it is important, to insure prompt delivery at the right destination, that all packages be properly marked. To this matter the shipping end of the Stone & Webster organizations in the United States and in France gave particular attention. Every crate intended for the Ordnance Base Depot carries on its side a triangle and the initials "S. W." painted in black, together with a complete description of its contents.

The explicit marking aids in the routing of the crate to its proper place on the job. Initials O. B. D. in the triangle identify the crate at once as intended for the Ordnance Base Depot. The serial and package numbers aid in checking invoices; the plant and building numbers leave no doubt as to where the machine is to be installed.

For the handling and routing of Ordnance Depot material arriving in France men were stationed at every base port. Shipments leaving the United States may arrive at any one of several ports—no one knows in advance the point of landing. The method followed in checking up was substantially as follows: On receipt of a ship's manifest at a base port the representative at that place would at once communicate with his headquarters office and receive instructions as to routing of the material, for half a dozen of the ordnance buildings were set up at other sites than the main depot. The record of the material received was made in the form of a quadruplicate report. One copy of this report went to the administrative headquarters in France, two copies were sent to the job, and the fourth was retained by the checker at the docks. The two copies reaching the job were checked up against material actually delivered, one copy was retained for the job files, and the other was sent to administrative headquarters as a receipt of the shipment. On Aug. 15, 2400 carloads of material had been delivered to the base depot and 48 carloads were en route.

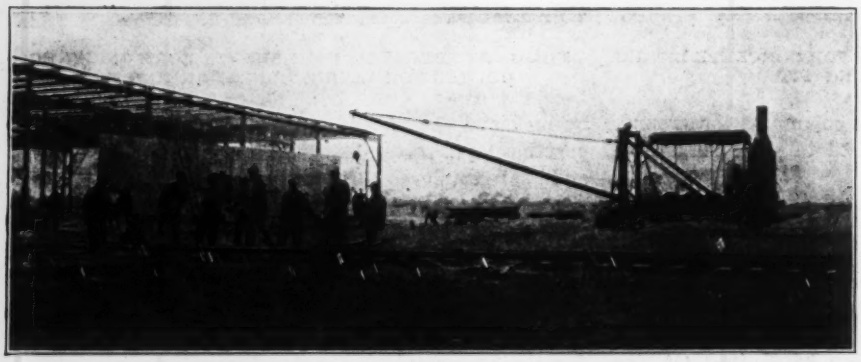


FIG. 10. AUTO-CRANE WHICH SPEEDED UP THE ERECTION OF STEEL WORK

Construction Plant—While construction plant did not arrive in time to aid in the first stages of the job, notably in building the railroad siding, and in unloading the first shipments of material, a considerable number of machines of various types was delivered later and have been responsible in large measure for the progress made. "We didn't even havea track jack when we began the railroad work," said a captain of engineers,

in telling me of the early difficulties encountered. "Mud was one of our chief enemies early last spring, and the use of wheeled vehicles for distributing material around the job was simply out of the question. Why, in walking across the site of the gun-shops the mud would build up on a fellow's boots in a broad, flat cake, so that after he had been going awhile he looked as if he had snowshoes on his feet."

The following table lists some of the more important construction plant used in building the Ordnance Base Depot:

Type of Machine	Number	Kind of Work Done
Locomotive cranes	2	Handling steel and crates
Steam shovels (¾-yd.)	2	Railway excavation
Hoisting engines	6	Steel erection and miscellaneous
Auto-cranes	2	Steel erection
Traction crane and bucket	1	Excavation of shrinking pit
Portable air compressors	4	Drilling, el. work, reaming and spray painting
Stiffleg derricks (10-ton)	4	Not yet set up
Road roller	1	Rolling floors
Wheelbarrows	Several hundred	Concreting and earth moving
Concrete mixers	4	Concreting column footings
Pavers	12	Machine tool foundations, and lining shrinking pit
Portable (¼-yd.)	3	Handling cars
Locomotives		

There is an abundance of concrete mixers on the job. Those in use are serving the column footings, the machine-tool foundations and the shrinking-pit lining. The change in plans whereby concrete flooring for all of the shop and warehouse structures has been eliminated has left many of the mixers idle, and they will probably be shipped to other points in France where there is a demand for them.

For the Army all construction work at the big base depot is under the immediate direction of Major F—, commanding the 501st Engineers, which consists of four companies of about 250 men each. One of these companies, however, has been assigned to duties connected with the handling of a railroad yard some miles away. In addition, there are detachments of ordnance units, several hundred Chinese, negro labor battalions and a so-called detachment of Spanish labor. Referring to the last unit, Major F— told me that shortly after the men had arrived on the job his interpreter came into the commanding officer's barracks looking absolutely fagged out.

"Did you get things all straightened out with that Spanish outfit?" inquired the major.

"Spanish!" sputtered the interpreter; "I've checked them over, and there are fourteen different nationalities represented in that bunch. Anybody that wants my interpreter's job can have it right now."

Wages for Foreign Labor—The Spanish labor is paid from 8 to 12 francs per day and board. Chinese labor is cheaper. The Orientals receive a minimum wage of four francs daily, plus food and lodging, and in addition there is a payment of 1.50 francs per man per day made to the French for the privilege of using this labor. The Chinese are good on simple jobs involving repetition of operations. For example, in connection with some of the roof work, 50,000 pieces of wire had to be cut to a certain length and twisted to a certain form. One of these pieces was made up as a sample and turned over to a detachment of Chinese. The remaining 49,999 pieces turned out by the Chinese did not vary a hair's breadth from the original model. "They copy a thing of this sort so perfectly," said Major F—, "that you would think the job was handled by a machine."

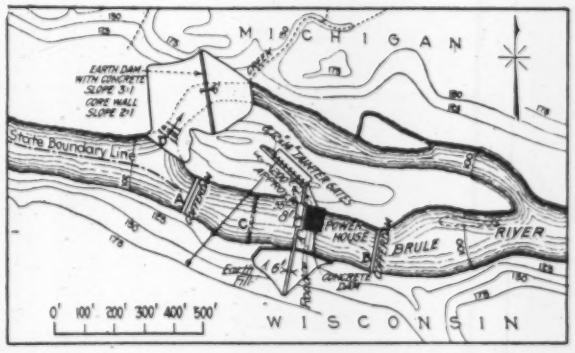
What the advent of mechanical plant on the Ordnance Base construction has meant in speeding up the job is indicated by one illustration. The steel-work for the first warehouse, 240 x 500 ft. in plan, took about three weeks. For the second, after the auto-cranes, hoists and other plant were available, the time of steel erection was about 4½ days.

Closure of Concrete Dam Completed Behind Needle Dam

Two Channels Formed by Island Simplify Problem of River Control by Cofferdams in Water-Power Plant Construction

EXCEPTIONAL use of cofferdams solved the problem of stream control in constructing the new Brule River plant of the Peninsular Power Co., in Wisconsin. Besides dams for diverting the stream and inclosing the construction operations in the stream beds, an ingenious combination of needle and flap-gate cofferdam was devised for backing up the water while making the closure of the concrete portion of the dam left open to pass the flow during construction.

Where the new power plant dams the Brule River, high banks inclose the stream and an island divides it into two channels, as shown by the map. The power



FLOW OF STREAM DIVERTED ALTERNATELY TO NORTH AND SOUTH CHANNELS

house and a short section of concrete dam close the south channel. The north channel is closed by an earth dam with a concrete core wall. On the low part of the island is a second short concrete dam and a spillway of Tainter gates.

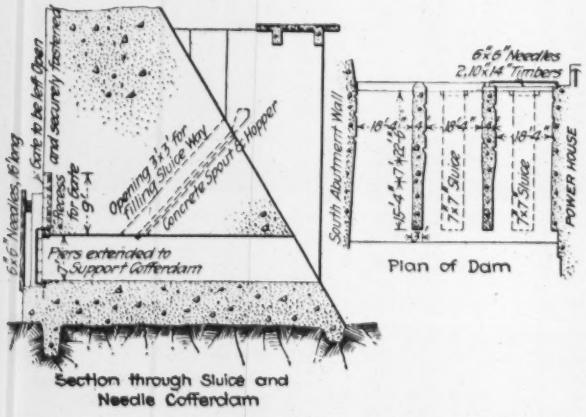
Construction was begun in June, 1917, and will be completed in 1919. In general, the plan of procedure has been: First, diversion of the stream through the north channel, and construction, to above water level, of concrete structures in the south channel; second, rediversion of the stream through the south channel, and construction of the earth dam in the north channel; third, the backing up of the south channel flow and completion of the closure of the south channel dam. Operations 1 and 2 have proceeded simultaneously, in some measure.

Work began on the south channel structures. Near the head of the island a cofferdam, A, was carried across the channel. Here the water had a maximum depth of

5 ft., and the stream bed consisted of gravel and boulders overlying bedrock. A rock-filled timber-crib dam was constructed and sheeted on the upstream side with 2-in. tongue-and-groove planks. This dam diverted the stream through the north channel. To protect the lower end of the works from back flow a second cofferdam, B, was constructed. Water here was only 2 ft. deep, and a dam of A-frames, sheeted on the downstream side with 2-in. tongue-and-groove planks, met the requirements. Dams A and B inclosed the south stream bed operations.

Seepage through the upper dam A was small, but to reduce pumping as much as possible a secondary earth-fill dam, C, was constructed about 200 ft. downstream. A fall of about 2 ft. between the upper and the lower main dams permitted a sluice, located along the south edge of the island, to carry the water ponded by the secondary dam to a discharge below dam, B. Two 4-in. diaphragm pumps then unwatered and kept dry the stream bed needed for construction.

Under the power house and south dam, bedrock lay only about a foot below stream bed. Excavation to get to sound rock was a hand-loading and dump-cart operation. Construction of the power house and of the two wings of the concrete dam followed. For the south wing of the dam only the foundations and the south abutment were completed; the dam section proper, as shown by the drawings, was left open except for two narrow diaphragms, of the section of the dam, which were built up like two piers and which divided the opening into three 18-ft. sluices for passing the stream until closure. The power house and the north wing of the dam were constructed complete. After completion of the south channel structures, as described, a cofferdam,



NEEDLE COFFERDAMS BACK UP WATER FOR FINAL CLOSURE OF THE DAM

D, was built across the north channel and the stream rediverted through the south channel and the sluices in the south wing of the concrete dam.

Excavation was next begun for the core wall of the earth-fill dam across the north channel. The core-wall trench was carried down 18 ft. below the stream bed. After the core wall was concreted, as described later, the earth fill was begun. A ¾-cu.yd. steam shovel loaded the earth in 1¼-cu.yd. dump cars which traveled to and dumped into the fill.

The concrete construction included the south channel dam shown in section by the drawing; the foundations, forebay and wheel pits of the power house; the foundations and piers for the Tainter gates, the core walls and the necessary dam abutments.

All the concrete was mixed at and distributed from a plant on the south bank of the river. Here the mixers were set at an elevation about 4 ft. above the dam top. Two steam-driven mixers of 12- and 16-cu.ft. capacity, and one electrically driven, 16-cu.ft. mixer constituted the plant. Only one mixer was operated, the two others being spare units. Storage bins for gravel were constructed above the mixers and a cement house alongside them. Gravel was excavated from a bank about ½ mile from the mixing plant, and was hauled in dump wagons to an elevated road above the bins, and thence dumped into the bins. Cement from a railway at Florence, Wis., was hauled by wagons to the same elevated road, and thence chuted into the cement house.

The concrete for the lower portions of the work was chuted to a hopper at the foot of the bank. As the work progressed, the hopper was raised. Distribution from the hopper was by two-wheeled carts. Even the concrete for the core wall of the north channel dam was hauled by carts over the power-house site, dams and spillways. For winter work the concrete materials were heated by means of perforated steam pipes in the bins.

Closure of the south wing of the concrete dam was to be accomplished by backing up the water. As shown by the drawing, one of the 18-ft. openings will be closed by 6 x 6-in. needles. Behind this needle dam the gap will be filled with concrete, except for a 7 x 7-ft. sluice, which will be fitted with a wood flap-gate. The second and third gaps will be closed by similar methods, except that the third gap will be completely closed. Until the final raising of the water the two 7 x 7-ft. sluices will remain open. At that time the gates will be closed, and the sluices will be filled with concrete by means of the spout indicated on the drawing.

J. R. McDonald, Black River Falls, Wis., is general contractor for this work on a cost-plus-fixed-sum basis. Daniel W. Mead and Charles V. Seastone, Madison, Wis., are the chief engineers, the entire work being done under their supervision. They are represented on the work by A. M. Trester. O. C. Davidson, Iron Mountain, Mich., is the president of the power company, and F. E. Turneaure, Madison, Wis., is the secretary-treasurer.

Work at Head Office of Highway Department

That the routine work in the main office of a state highway department is large is shown by the report of H. Eltinge Breed, first deputy highway commissioner of New York State. This report, recently issued, covered the year 1917. Some of the work reported consisted of the following: Making 31,689 blueprints and 4643 white prints, of which 4178 were on cloth; 335 sets of highway plans on cloth, averaging 12 sheets each, 609 sets highway plans on paper, averaging 13 sheets each; 5385 prints of 500-ft. scale maps; 3000 cross-section prints; 2700 right-of-way prints; 5500 maintenance and repair prints; 6500 miscellaneous prints of forms, etc. A total of 149,504 sq.ft. of paper and cloth was used for this purpose.

Developments in the Practice of Laying and Manufacturing Paving Materials

War-time restrictions have had a marked effect upon progress in the field of pavement construction. Output has been cut to a minimum, by both Government regulations and by uncommon economic disturbances. However, the following statements, obtained at the solicitation of "Engineering News-Record" from representatives of manufacturers of various materials, indicate that there has been considerable advance in the adoption of methods heretofore considered experimental, and that economies have been fostered or forced by the abnormal conditions. It is shown that much greater attention is being paid to proper drainage, smoothness and other details of construction, and that maintenance methods are being more closely studied. Mortar-bed or other rigid construction has become practically established for all types of block pavements, superseding the old sand-cushion design. Interesting adaptations of paving materials to war purposes are also recorded.—EDITOR.

Asphalt Block Adapted to War Purposes

BY EDWIN J. MORRISON
President, National Association of Asphalt Block Manufacturers

NOTHING notable was added during 1918 to the accepted practice in the building of streets and roads with asphalt blocks. Many Governmental restrictions confined construction to essential improvements of heavy-traffic roads where asphalt blocks were specified because of their demonstrated ability to carry heavy motor-vehicle traffic. The most interesting developments of the year were along the lines of working out labor-saving methods, in order to minimize the effects of extreme labor shortage and high wages. These efforts resulted in far-reaching improvements in methods of handling blocks, so that from the plant to the place of use, practically all hand labor has been eliminated, and mechanical devices have been designed.

A notable development of the year has been the demands of war and war industries upon the industry and the adaptation of the blocks to many military and essential war uses. Their utilization in war business has amounted to over 85% of the year's output for the company which the writer represents. The Navy Department has made extensive use of asphalt block at the New York, Boston, Philadelphia and Washington yards in flooring for storehouses, machine shops, etc., and at the great Brooklyn Navy supply base, where alone about 45,000 sq.yd. were used in flooring for storehouses, paving of loading platforms and streets around the plant, and paving connecting roadways between the buildings and the water front. These installations involved a very careful study of service conditions, in order to adapt the manufacturing formula to the production of blocks of requisite hardness, softness or malleability for special traffic and temperature conditions.

One unique problem urgently submitted to us was to produce an acid-resisting block for use in the flooring of a large submarine-battery storage building. This problem was successfully solved by the manufacture of a special block composed entirely of traprock, crushed to an unusual degree of fineness, and combined under high pressure with a processed cementing material. These blocks passed the severe tests of the Navy Department when subjected to a 25% sulphuric-acid solution.

In addition to many installations in ordnance and munition plants, the War Department selected asphalt block for extensive use in one of its most important plants—the South Brooklyn Army supply base—where more than 100,000 sq.yd. are being used in the flooring for the four piers, 1300 ft. long by 150 ft. wide; also for bridges, tunnels, loading platforms and traffic aisles.

The developments for the near future will probably be in the direction of the improvement of paving material and the design and construction of highways to carry the vastly increased motor-vehicle loads which recent military use has shown to be beyond the power of many existing highways to withstand.

A Negligible Year in Asphalt Paving

(From interviews with asphalt manufacturers)

GLOOMY prospects for new paving of every description marked the opening of the year 1918, on account of war conditions. Aside from any other features, the railroad situation was such that it seemed hopeless to figure on shipping paving materials with any degree of success at that time. Labor was extremely scarce, very high in price and in most cases inefficient; but the particular feature which affected the asphalt situation was the shortage of tank and other steamers to carry the crude asphalt from Mexico and South America and the impossibility of land transportation from other sources.

A large number of steamers carrying supplies for the American Expeditionary Forces were equipped to burn fuel oil, and it was especially desired that they should do so, owing to scarcity of coal. A great many Pacific Coast steamers which were fuel-oil burners were diverted to the European traffic, and all such steamers had to rely upon the Mexican oil for power. Consequently, the demands for oil were so great that it was necessary to make this the paramount feature in connection with the importation of Mexican asphaltic maltha.

In addition to there being a shortage of tank equipment, the importation of asphalts from South America was also greatly restricted by the action of the War Trade Board, which cut down the importation of these asphalts on account of the shortage of cargo steamers. These outstanding features, combined with the labor problem, made it a very negligible year in the construction and maintenance of asphalt pavements.

Maintenance has been the principal paving use to which asphalt has been put, and surface treatments have been used to some extent. Considerable patching has been done by "cold-patch" methods, using asphalt.

The fact that the maintenance of so many streets and roads had to be neglected, and the widespread and insistent demand for new roads and streets, would portend that the year 1919 may be a very busy one.

Status of Paving Brick in Manufacture and Use During Past Year

By Will P. Blair
Vice-President, National Paving Brick Manufacturers' Association

NO DISTINCTIVE advance in the manufacture of paving brick has developed during the year. Progress is always in the mind of the manufacturer, covering two essential phases of the business: (1) Economy of production; (2) betterment of quality.

Generally considered, manufacturers do not hope for any special development which will increase the quality of paving brick. They do, however, bear in mind that care and skill must be constantly exercised, or quality will depreciate. The best known methods must be skillfully applied in each step of manufacture—preparation of the raw material, its formation, its drying and its burning—or, properly speaking, its vitrification.

In the economical phases of production, considerable hope is felt that some special saving may be achieved. Economy in fuel is a large question, to which many engineers are devoting much time. It is most important in the manufacture of paving brick, because the great proportion of expense is for the large amount of fuel consumed.

Economical handling, in both the processes of manufacture and of loading for shipment, is open to improvement. Special skill and devices, many of which have been patented, embracing almost numberless designs—all of more or less merit—have been brought into existence; but neither a particular method of fuel consumption nor any of handling has attained general approval.

In the use of paving brick throughout the year but few really new methods have been suggested. West of the Mississippi River the use of a bituminous filler is adhered to almost universally.

Throughout the Central states, the use of the sand cushion underneath the brick in connection with the use of cement filler has been almost wholly abandoned. In its place the method known as "the green-concrete-foundation method," which consists in laying the brick in the wet concrete, is extensively used. South of the Ohio River, particularly in the Gulf Coast section, also, this method is becoming popular.

Both in the Central and Eastern parts of the country there is frequently employed the type of construction known as the "sand-cement superfoundation," which consists of mixing the cement with the sand in a dry state and laying the brick thereon, after which the sand and cement is thoroughly dampened.

There has been a suggestion—in theory meeting the approval of a number of students of construction—to lay the brick upon a bituminous base or foundation. However, this method has not been tried out sufficiently.

During the past year the subject of drainage (always of frequent mention, but seldom seriously undertaken) has gained in importance. F. R. Williams, paving engineer, Cleveland, reports an interesting experience the past year. Improvement of Woodhill Road was designed for the monolithic or green-concrete-foundation type of brick pavement. The road skirts the foothills throughout the greater part of its length, so that the fall of water through the plastic soil has been the source of much trouble. Drains were laid outside of either curb and at sufficient depth to carry the water into the manholes. Cross drains discharging into these were laid under the entire base of the pavement, with sufficient fall to remove the water quickly from the subgrade. It was immediately observed, following severe downpours of rain, that the subgrade was quickly relieved of water, and the contractor was able to resume work with little loss of time due to weather.

Such advantage in construction economy was established by this drainage that contractors have installed it without cost to the city even where their specifications did not call for it. This experience not only established a construction economy, but clearly demonstrated that such a complete drainage system insured a continuous dry subgrade, and thereby the durability of the road.

Sees Development in Maintenance and Repair by Tar Products

By John S. Crandell
Consulting Engineer, General Tarvia Department, The Barrett Company

EXPERIENCE during the past year has emphasized the necessity for careful laboratory control and strict adherence to standardized methods, in the manufacture and use of paving materials. Especially has this been true of tar products. Control at the plant has been insisted on more than ever before, with the result that the output has been satisfactorily uniform. In the actual road work it has been necessary to try new methods, for the shortage of labor and its high cost have made economy obligatory. Furthermore, the restrictions placed on the highway builders by the Highways Council have caused the former to repair and maintain many miles of road that, under former conditions, would have been rebuilt. In consequence of this, patching and maintenance materials have been used to a greater extent than materials of construction.

For the repair of bituminous roads, cold patching has assumed a leading place. Tarvia-KP has been used in quantity by the various state and town highway officials. It has shown what can be done to keep roads in good condition at slight expense. Concrete roads have been repaired and kept in service by the use of Tarvia-XC; this is the material recommended by the Association of Portland Cement Manufacturers for patching and for mending cracks in concrete roads.

In actual road construction a new method has been standardized. This is the cold-penetration method, using Tarvia-B to take the place of water in the water-bound road. The results appear to have fully justified the slight increased cost of tar over water-bound macadam. The roads built by this method in Camp Douglas, Wisconsin, have carried heavy camp traffic. Enough roads of this type have been built to standardize the method of construction.

What may have been the established practice for many years in one locality may be a novelty in another. Surface treatments with Tarvia-B have been standard practice in many regions for years, but in others this past year has been the first in which they have been tried. With the increase of heavy truck and swiftly moving pleasure-car traffic, and with the scarcity of labor, the necessity of preserving existing macadam and gravel roads has been placed upon the entire country.

The greatest development looked for in the near future is the return to the tar-bound base. A number of articles have been written during the past few months on this subject, which show plainly that engineers are interested. The undisputed success of this type of foundation in many widely scattered cities points to its possibilities and offers interested engineers an opportunity to investigate. Specifications covering the materials and method of construction have been prepared and published in periodicals. The tar-bound base has been used under sheet-asphalt and block pavements.

Another development looked for is the patching of brick and the mending of the cracks in grouted brick pavements with Tarvia-XC in the same manner in which cement concrete pavements are now repaired. Many of the brick pavements that have failed could have been saved, probably, for some time, if the cracks and holes caused by local disintegration had been filled with Tarvia-XC at the time of their appearance, and before the adjacent pavement began to shatter.

Another future development expected is the treatment of wood-block pavements that bulge and heave, due to absorption of moisture. If these dried out blocks receive a treatment with a light tar, they become waterproof.

Highway Engineers Perfect Details of Concrete Road Construction

By A. N. Johnson
Consulting Highway Engineer, Portland Cement Association

EXPERIENCE during the past year with heavy war traffic has demonstrated the necessity of thoroughly substantial pavements, so that thicker roads will be more generally designed and built. Concrete roads should be not less than 6 in. thick at the side and about 8 in. in the center for widths up to 20 ft. On main traveled ways, a thickness of 8 in. at the side and 10 in. at the center should be laid.

With the greatly increased use of concrete for roads, highway engineers are giving more and more attention to perfecting details of construction. There is probably no single development in the manufacture of concrete of more significance than a proper water content. An appreciation of this fact has been made possible chiefly through the exhaustive investigations carried on under the direction of Prof. D. A. Abrams of Lewis Institute, Chicago, made in coöperation with the Portland Cement Association. By controlling the water content, the strength of the concrete can be increased from 50 to 100 per cent.

It was formerly the practice to specify 1½ in. as the limiting size for the largest aggregate. It is now generally recognized that the largest aggregate may well be 2 in., and many engineers are using aggregate as large as 2½ in. It is of more importance to have clean aggregates than it is that particles of aggregate shall be of the hardest and toughest variety. In fact, it has been shown by the service rendered on many concrete roads that aggregate which is too soft for use in macadam roads does make a concrete road that will withstand without appreciable wear the heaviest motor traffic.

The importance of testing aggregates, particularly the fine aggregates, for organic impurities has received prominence in recent practice. The colorimetric test devised for this purpose can be readily made in the field, as only the most simple apparatus is required. The test is made with a 3% solution of sodium hydroxide in which the fine aggregate is shaken, the organic impurities being readily detected by the dark color of the liquid after settling. Light yellow or amber color indicates freedom from organic impurities that will injure the concrete, while a pronounced tan or light brown color indicates an amount which should not be allowed in aggregate for concrete road work.

Thoroughly mixed concrete is recognized more and more as essential to the best results, so that now practically all state specifications require not less than 1 min. of thorough mixing of all materials. The most common mix is 1:2:3, but some engineers require 1:1½:3.

Special attention has been given to the development of as perfect a surface as possible for concrete roads. Of first importance to secure this result are accurately placed and substantially built side forms, which should be rigidly held to the grade line. The roller-and-belt method of finishing has made it possible to secure a better surface than with the hand-float method. During the past year no less than 85% of various sections of concrete road work have been finished by this method, which is prescribed in many state specifications.

An improvement upon this method, and one that gives a remarkably true surface, is made by the use of a finishing machine so constructed that it automatically shapes and tamps the concrete. The machine can be reversed so that it is possible to go over the surface a number of times. This is of the highest importance, if the greatest density and strongest concrete are to result. Also, a much smaller quantity of water may be used in the mix, when finishing is done by this device, and this insures a stronger and better concrete.

Paint-Coat Method Becomes Standard Construction for Wood Block

By Walter Buehler
Chairman, Committee on Wood-Block Paving, American Wood Preservers' Association

DURING the past year the greatest advance made in the construction of creosoted wood block pavements has been the general adoption as a standard of the pitch paint coat method.

In January, 1918, the American Wood Preservers' Association's Committee on Wood-Block Paving submitted, as information, a specification for the laying of wood blocks directly on a smooth concrete base painted with a thin paint coat of pitch. At that time there were only a few examples of this form of construction. During 1918 more than 1,000,000 sq.yd. were laid in this way.

The principal precautions necessary to assure success, aside from the treatment of blocks, are: (1) Proper

proportioning of the concrete; (2) careful application of the paint coat; (3) proper application of the filler.

Concrete for this work should consist of aggregates so graded and proportioned as to assure a sufficient mortar content to permit of proper finishing. A mixture consisting of one part of cement, 2½ parts of sand and 5 parts of gravel or crushed stone, the gravel or crushed stone all passing a 1½-in. mesh and retained on a ¼ in., and with no intermediate sizes removed, will give satisfactory results.

A number of ways of finishing concrete have been developed. The simplest is by the use of a long handled float. The standard concrete roller-and-belt methods have also been used. E. R. Dutton, engineer of paving of Minneapolis, Minn., has developed a method which he asserts is working out successfully. It consists of a small pipe roller of about 3 in. diameter and about 15 ft. long. This roller is operated crosswise of the street on templets, consisting of 1 in. boards on edge, cut to crown of street and held vertically by specially prepared iron stakes driven into the subgrade. Whatever method is used, the important result is an even surface, but it is not necessary that it have a sidewalk finish.

Application of the pitch paint coat requires no special skill. It is important that the pitch be heated to at least 250° F. and that it be spread over the surface of the concrete in a very thin layer, not exceeding ⅛ in. thickness. The blocks should be laid after the paint coat has hardened. If possible, all paint-coated concrete should be covered with blocks each night.

To assure success, it is important that the blocks be properly filled. The pitch must be heated to a temperature of not less than 250° F. and not more than 325° F. It should be poured on the surface of thoroughly cleaned blocks and squeegeed rapidly in one direction only and should not be mopped back and forth. The ideal condition is a clean surface, with pitch filling about one-third of each joint.

Granite Block Laid on Mortar Bed and Adapted to Trunk Highways

By A. T. Rhodes
Field Engineer, Granite Paving Block Manufacturers' Association

There are several developments, both in manufacture and laying of granite blocks, which deserve the consideration of engineers and commissioners of public works—such as standardization of sizes, adoption of the mortar bed, and the recent adaptation of the blocks to trunk-line highway construction.

If any practicable method could be devised whereby paving block could be machine made, economically, this method would be adopted. When it is realized, however, that the subdivision is made from b[illegible] as large as 1 cu[illegible], and a block containing eight s[illegible]ndard sized pavers reduced to finished units in 90 sec., it can be seen that a skillful mechanic can make these blocks by hand much faster and more economically than could any present mechanical device requiring shifting of the blocks into various positions.

There is another condition in manufacture which would be very much improved if engineers would realize that they gain no particular advantage by sticking to their "pet" size of blocks. If blocks were standardized the producer could more readily hold a large stock of material, having confidence in the ultimate sale of any standard style. As there are schedules of sizes under which paving cutters sign annual agreements, and as any deviation from these sizes in the way of specials calls for an increased charge, a standardization of sizes to not more than three or four would give confidence to these producers and effect an economic saving.

From a construction standpoint, 3½-in. granite blocks are coming rapidly to the front as resurfacing for worn-out pavements of various types. Where these were constructed originally with good concrete bases, sufficiently low for laying, this method is proving satisfactory.

Probably the greatest change from the original construction methods, during the past few years, is the elimination of the use of peastone to hold the blocks while ramming. It is probable that more failures occur in granite paving through the use of peastone than are occasioned in any other way.

Cement-grout filler of 1:1 mix is unquestionably the best. In connection with this, it is found better to eliminate pargeting, or plastering, of the rails of street-railway tracks, and allow the grout to run in against the rail itself. The grout makes a much better bond with the rail, is a more substantial mixture and has been —in one instance, at least—the support of the railway iron for three years after the ties were rotted out. Where grout filler is used, a bituminous expansion joint along the curb is coming into practice.

Another change in practice is toward the mortar bed instead of the old sand cushion under the blocks. This bed should be a 1:3 mix, in the writer's opinion. It is laid dry and is wet down after the blocks are rammed, so as to give it a set and a bond with the cement filler.

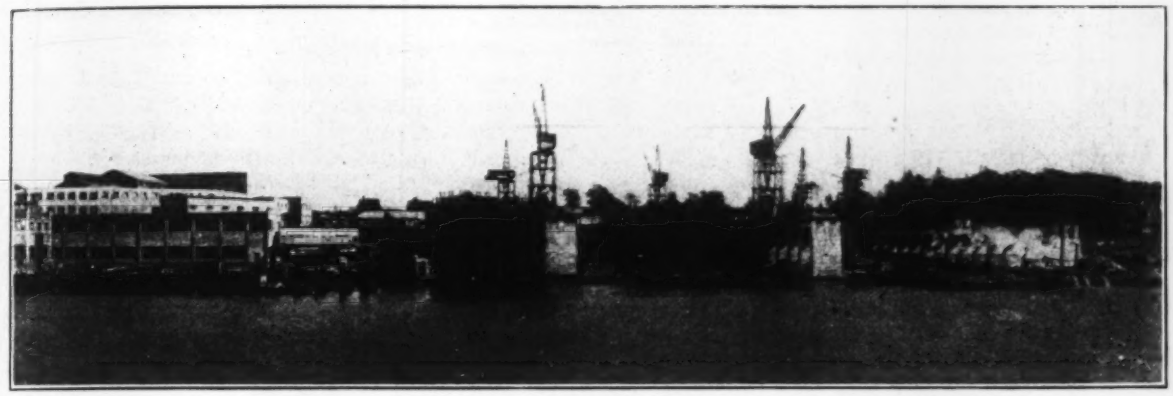
The use of the bituminous mastic filler is more or less in its infancy, superseding the old peastone and pitch type of joint filler. It cannot be expected that it will show the durability of cement grout filler, but circumstances, such as opening the street immediately to traffic, instead of waiting six days, and giving a better footing for horses and facilitating the making of pavement cuts, make its use advisable in many cases. To obtain the best results, it must have a quality of extreme fluidity (so that it will flow readily to the bottom of the joint), a high melting point (so that it will not bleed in the hot weather) and have strong adhesiveness. This, to my mind, could be obtained best by a mixture of tar and asphalt, but producers are opposed to supplying a mixed product. The proper proportion of sand for this mastic filler is from 35 to 50 per cent. It is difficult to use a greater amount of sand without extreme care.

One of the newest developments in the matter of granite-block paving is its entrance into the field of trunk-line [illegible]away construction. With the increased cost of all other paving material, it has been found that by slight changes in the type of construction granite-block can compete for this work with most of the more permanent paving materials. The concrete base is omitted and a cement-sand bed, as described above, 1½ in. deep after ramming, is spread directly upon the prepared subgrade. The blocks are then laid and grouted. This gives a monolithic pavement which compares favorably in cost and in wearing quality with others of equal thickness.

Groton Shipyard Built on Sloping Limestone Ledge

Fabricating and Storage Yards Level with Rails on Concrete Crane Ways and 22 Feet Above Concrete Shipways Set Into Rock

SIDE-HILL topography, unusual in shipyard layout, has been utilized successfully in the new yard of the Groton Iron Works at Groton, Conn., on the east shore of New London harbor. Advantage has been taken of the high land inshore to develop a two-level yard in which the material is fabricated and stored on the level of the rails of the crane runways, which themselves are some distance above the shipways. Concrete has been used extensively in the craneway and shipway construction, blacksmith shop, machine shop and fitting-out dock, though, on account of the speed necessary in erection last summer, many of the buildings have wood-frame members.

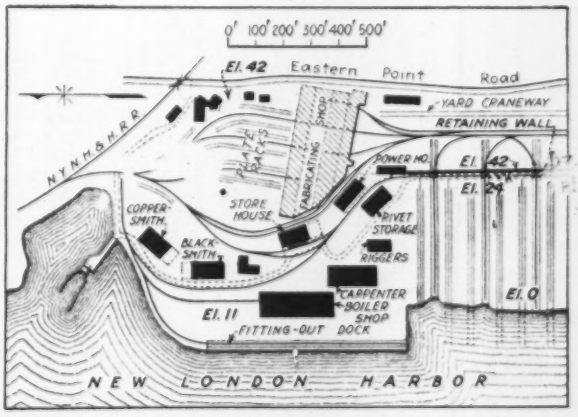


NEW SHIPYARD AT GROTON, CONN., IN OPERATION LATE LAST FALL

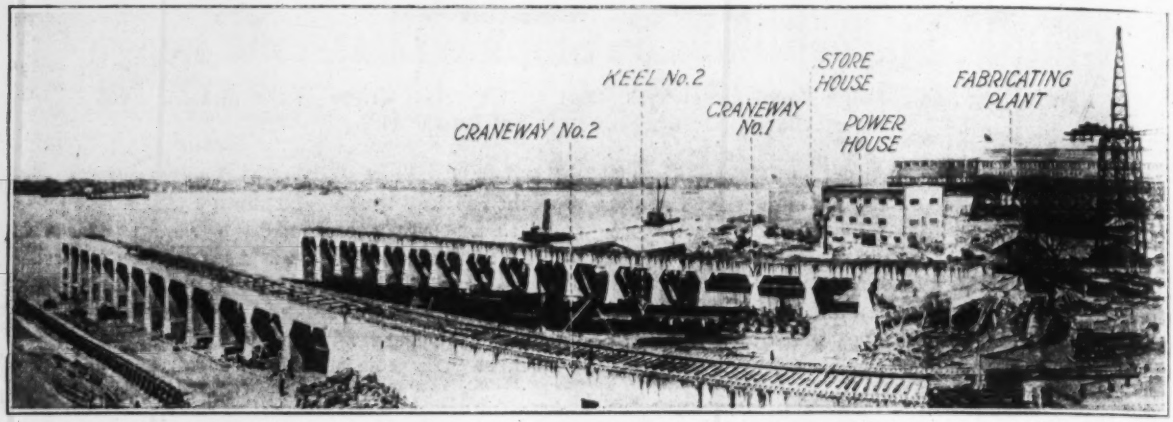
When the company took over the site in the spring of 1918, it was a country estate, similar to many of those lining the shores of New London harbor, a grassy slope underlain very close to the surface with a granite ledge sloping on a grade of about 1 in 15 down to the water. The site embraced 20 acres between the water and a main highway, and is traversed at the north end by the old main line of the New York, New Haven & Hartford R.R., which in the days before the Thames River was bridged had a ferry at this point running over to New London. The layout of the yard is shown on the accompanying drawing. Six end-launching ways were located at the south third of the yard. The northern two-thirds was left essentially on its original slope, so far as rock excavation was concerned. The tracks and buildings were laid out to accommodate themselves to the varying topography. During the construction of the yard, there was excavated approximately 15,000 yd. of ledge rock.

The ship ways are divided into three groups of two. Each group is controlled by a centrally located concrete trestle which supports two traveling cranes and a central standard-gage track for the purpose of supplying material to be placed in ships. The ways themselves slope on a grade of $\frac{3}{4}$ in. to the foot from an elevation of 24 ft. at the head of the way to $2\frac{1}{2}$ ft. at the low-water line. The grade at the top of the craneway and the assembly yard at the east of the craneway, as well as at the fabricating shop and storage yard at the north, is 42 ft. The supply tracks and the craneway tracks are placed at the above elevation. As shown on the cross-section of one of the sets of ways, a rubble-stone and concrete retaining wall, located at the head of the ways, separates the upper level from the lower level.

Each shipway consists of a central keel blockway, and two parallel launchways. All three ways are of concrete of rectangular cross-section, varying in depth from 2 to 4 ft., and resting on ledge rock. The ledge rock is leveled off to a transverse level cross-section, but slopes with the shipway to the water. This rock surface presents a floor on which are placed the bilge shores for the support of the hulls. The launchways are made wider below water for the purpose of construction only, and are carried out so that with a maximum tide 9 ft. of water will be available at the outboard end. The keel block way, mentioned above, is constructed in steps so that keel blocks could be placed on a level base. These steps were made in multiples of



GROTON IRON WORKS SHIPYARD BUILT AROUND A TWO-LEVEL LAYOUT



HIGH-LEVEL CONCRETE CRANE RUNWAYS AT CROTON YARD IN EARLY STAGE OF WORK

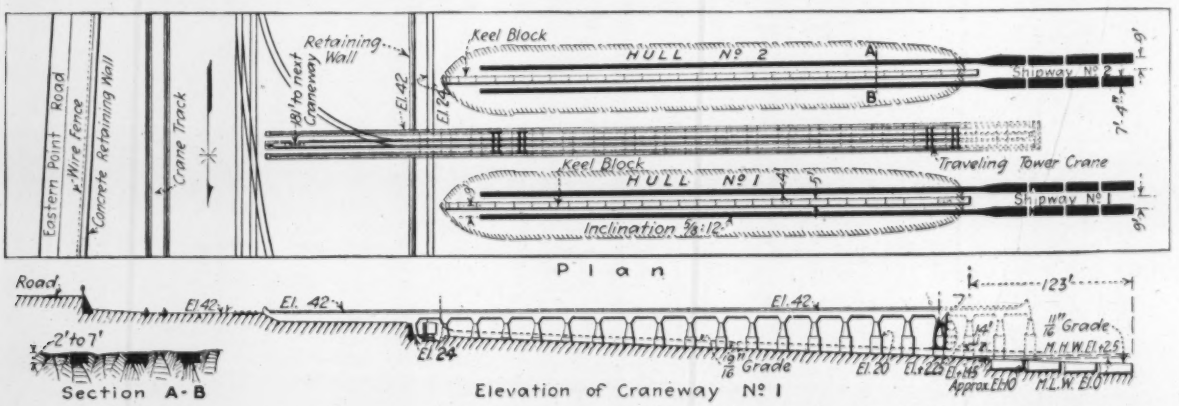
4 ft., as keel blocking is placed on 4 ft. centers. The keel block way extends but a short distance below high tide—in fact, just far enough to provide a foundation for stern post struts. The average amount of concrete in the six shipways is approximately 1200 cu.yd. In this concrete no reinforcing steel has been used, excepting as anchors, etc.

The craneways are of pier-and-girder construction, as shown in detail. The piers for the craneways are built of rubble concrete without steel, except for quill rods, etc. In some cases, rubble masonry was laid around the perimeter for the first section of the pier, and the interior filled with concrete. In all cases the piers were designed on the assumption that at least 50% of the volume could be constructed without cost over and above the cost of excessive formwork, as the great amount of granite excavation left available a ready supply of stone for this purpose. The girders, two for the crane rails and one for the central supply track, were reinforced and designed as simple beams, with the joint over the center of each support. Each of the three craneways contains approximately 3500 cu.yd. of concrete.

The traveling cranes are of Terry & Tench manufacture, and are designed for a working load of five tons at 87½ ft. and 12½ tons at 52 ft. The weight of the crane, consisting of steel frame, counterweight, machinery, etc., is approximately 107 tons. The cranes are operated by a direct current, 220-volt, 65-hp. motor for hoisting, a 25-hp. motor for swinging, and a 65-hp. motor for transit. The power is transmitted by means of two 50-lb. steel rail conductors by means of collector shoes. These conductors are carried on special framework, insulated and protected between the girders of the trestle. The eastern 100 ft. or more of each craneway is constructed on concrete walls carried down to rock—that is, where the height of the trestle was not sufficient to warrant the construction of piers and girders.

The movement of material through the yard is readily understood from the drawings. Practically everything comes in on the railroad at the north end of the yard, and is carried on standard-gage tracks, and stored in racks near the entrance. These racks are so constructed with concrete bases and steel uprights that the unfabricated material may be placed in storage, according to size and thickness, and on edge so that it can be removed with a minimum of labor when any particular section is required. Material requiring shopwork then proceeds on standard-gage tracks to the fabricating shop, where it is fabricated and sent to the storage yard in the rear of the craneways, or diverted to the machine shop, blacksmith shop, pipe shop, or fitting-out dock, as the case may require.

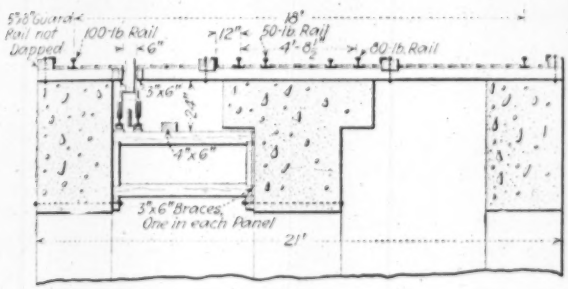
A large part of the assembling of structural parts is carried on in the inter-track space, adjoining the south side of the fabricating shop and east of the craneways, which is called the "assembly yard." It has been found to be more economical to assemble boilers, engines, condensers, channel foundations, shaft channels, bulk-



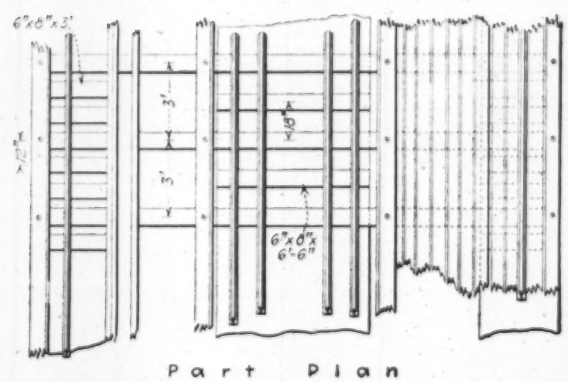
CONCRETE SHIPWAYS SET IN LEDGE ROCK AND CONCRETE CRANE RUNWAYS AT HIGH LEVEL

heads, funnels, uptakes, skylights, fantails, deck houses, floors, girders, pillars, brackets, etc., in this assembly yard, and transport them within reach of the traveling cranes by locomotive cranes. There, by means of an equalizing bar, structural units weighing upward of 20 tons have been placed by two traveling cranes. In the assembly yard, there is being constructed a craneway for a Terry & Tench crane similar in design to those mentioned. This will be used exclusively for assorting and assembling all the structural units mentioned above.

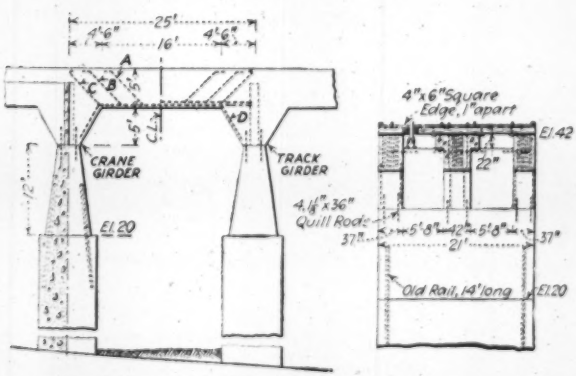
Operating in the yard, on the standard-gage tracks, are four locomotive cranes, one 35-ton crane, and three 20-ton cranes. These cranes are used in all parts of the yard, primarily for the purpose of unloading steel from cars and placing it in the plate racks, also coöperating with the traveling cranes in placing fabricated material in the hulls. The traveling cranes are so designed that material on cars can be pushed out onto the craneways under them; and, also, the locomotive cranes mentioned above can, when the case requires, be operated on the craneway in conjunction with the traveling cranes.



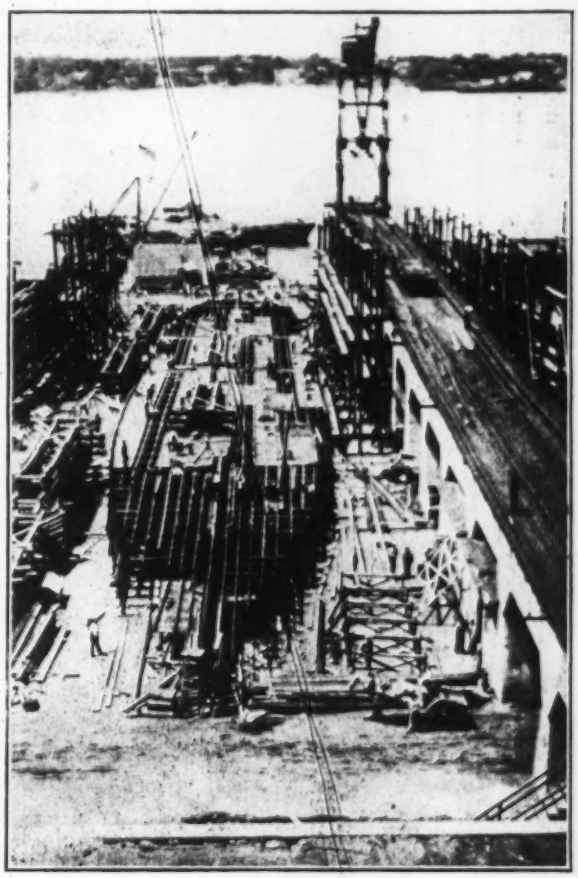
Section through Craneway Trestle



Part Plan



DETAILS OF CONCRETE TRESTLE AT SHIPYARD OF GROTON IRON WORKS



LEVEL ROCK WAY PERMITS STORAGE OF MATERIAL ALONGSIDE HULL

The main entrance track extends the entire length of the yard, east of the store house and power house, and east of the craneways. A turnout taken off near the north entrance extends to the west of the store house and power house and under the craneways at an elevation of approximately 21. From this track a turnout to the left extends north, and leads to the machine shop, carpenter shop, and fitting-out dock by means of sidings. The above track, extending west of the power house and under the craneways, is of great value for the purpose of transporting material from the machine shop, blacksmith shop, or carpenter shop to the ships before launching. This does not interfere in any way with the work in the fabricating shop or assembly yard. This track is paralleled by a roadway for the use of motor trucks, to accommodate the relatively small amount of material received in this manner.

In addition to the railroad entrance to the yard, there is a fitting-out dock, with a deep-water approach, over which material may be brought in by water. Roads have been built throughout the yard to facilitate motor-truck delivery, both from the main highway and from the dock. Keels have been laid on each of the six ways, and construction is going forward on each hull.

E. A. Morse is president of the Groton Iron Works, and E. O. Cutler vice-president and manager. The layout arrangement and equipment of the yard have

been personally directed by Mr. Cutler. The construction work has been done during the past 16 months, partly by contract, and partly on force account. The F. T. Ley Co., Springfield, Mass., constructed a section of the fabricating shop and one craneway. The Raymond Concrete Pile Co., New York, constructed the outboard launch ways. The T. A. Scott Co., New London, constructed the fitting-out dock. The remainder of the work was done by force account. G. L. Bilderbeck has been the construction engineer in charge of the structural design from the beginning of the plant construction. Arthur Jackson has been superintendent of construction in charge of the greater part of the force-account work.

Engineering Educators' Opinions Reflect Past and Predict Future Conditions

This is the second installment (the first appeared in "Engineering News-Record" of Jan. 2, p. 41) of replies to the following questions:

1. What was the influence of the Students' Army Training Corps upon the engineering colleges? Did the experience affect the educator's viewpoint, and if so, how?

2. Will the return to peace mean a return to pre-war courses without essential modification? If not, just what changes are contemplated? What considerations determined these changes?

3. Have you embodied in your plans for after-war courses any of the suggested solutions brought out by Dr. Mann in his "Study of Engineering Education"? (See "Engineering News-Record" of Oct. 24, p. 782). If so, just how are they to be applied?

4. What is your estimate of the new needs and opportunities in engineering education developed as a result of the war? How can they best be met?

Cornell Believes in Military Training, in Spite of S. A. T. C.

By E. E. Haskell
Dean of the College of Civil Engineering, Cornell University, Ithaca, N. Y.

THE experience with the S. A. T. C. at Cornell was rendered unsatisfactory by the actions of younger officers, and the fact that orders to the military instructors and to academic authorities were not in duplicate, resulting in confusion and conflicts in student hours. The general feeling in regard to the work of the corps was expressed when the faculty voted unanimously to refuse the opportunity for continuing the training to the end of the present year. Nevertheless, there is still a strong feeling that military training, properly coördinated with academic work as it has been administered here for freshmen and sophomores ever since the University was established as a land-grant state institution, is a very essential part of the young men's training. Indeed, President Schurman hopes to see at Cornell University regular military and athletic training for all students for a period of not less than one hour for five afternoons of the week, with intra-mural competition between class and class, college and college, and other existing units.

The Navy unit, about 350 men, was administered successfully, but the Army unit, about 1200 men, accomplished relatively little academic work. Study facilities were inadequate, and officers monopolized the time in the evenings which should have been devoted to preparation for class work. In reply to the four specific questions which you submit I would say:

1. In view of the unsatisfactory nature of the experience with the S. A. T. C., there has apparently been no definite influence on the engineering college here.

2. We are returning to our pre-war courses on Dec. 30, and are planning to extend the third term into the summer, probably for a period of eight weeks beginning July 1. A faculty committee is considering changes already debated before the war, but no definite lessons from the war experience have yet been discussed. Last spring the trustees of the university decided in favor of the principle of consolidation of the several existing engineering departments into one department of engineering education.

3. Dr. Mann's report is being used, with other sources, for determining modifications of the present courses. Professor Jacoby is strongly in favor of the idea of making the academic work relate itself closely to practical engineering. In fact, he has for years used in his classroom work a specific problem method, with topics written out on cards. This method was extended recently to include definite questions for classroom discussion, also stated on cards. Since the cooperative courses are impracticable, it is contemplated to have students use the summer vacations for work in the fields in which they are most interested. He urges the selection of teachers who have had practical experience, and also the necessity for providing them with courses in educational psychology. The simultaneous use of both objective tests and examinations is favored. It is hoped to reduce the differentiation between courses in the freshman year, and a line may be drawn

between the sophomore and the junior years in order to insure the success in their specialties of those students who continue. A course designed to show the relation of engineering to industrial organization is contemplated. The courses in physics, mechanics and mathematics should be given by teachers who know engineering.

Stevens Institute Going Back to Pre-War Conditions

By Alexander C. Humphreys

President, Stevens Institute of Technology, Hoboken, N. J.

REPLYING to your letter of inquiry, the situation has not yet so cleared up as to enable me to express *final* opinions as to the workings and influence of the S. A. T. C. on the educational life of the United States.

1. We have to recognize that the S. A. T. C. was not given full opportunity to demonstrate its positive influence for good.

2. As far as Stevens Institute of Technology is concerned, I see no reason for not returning as rapidly and completely as possible to our pre-war conditions.

3. I am unable to find in Dr. Mann's survey anything that would be of particular value to *us*. Here we have to bear in mind that our course of instruction is a fairly harmonious blend of theory and practice. With us "the proof of the pudding is in the eating."

4. The war has emphasized the value of engineering education, as indicated in my answer to the third question.

In general, the S. A. T. C., as exemplified in the Army section, was sadly handicapped by Washington red tape. For this the Army officers assigned to Stevens were in no way responsible. The operations of the Navy unit were, by comparison, free from this disorganizing red tape influence. I give my views based upon the operations and results as they *now* appear to me.

I was and am in favor of a certain amount of military training for engineer students. I regret that the Army section of the S. A. T. C. has not helped to confirm me in this belief.

Need for Broader Training Seen as Result of War Experience

By William G. Raymond

Dean of the College of Applied Science, University of Iowa, Iowa City, Iowa

I AM very sorry that the S. A. T. C. was discontinued, for while it was a dismal failure while it lasted, it was improving and under modified administration I believe would have been tremendously successful. Answering your questions as best I can with the limited time available for their consideration, I would say:

1. The S. A. T. C. tremendously increased attendance in engineering colleges, but with a temporary increase, much of which will be lost with the close of the organization. I am not sure that the experience affected the educator's viewpoint at all. I find it difficult here to disassociate the effect of the S. A. T. C. and the general effect of the war, which, it seems to me, did affect the educator's viewpoint in that the necessity for a broader training in economics, sociology, accounting, etc., was made manifest.

2. I think this question is answered under No. 1. In our institution we shall get back to pre-war courses with some modifications, the nature of which cannot be definitely determined now, but which will be in line with the suggestion in the answer to question 1.

3. I have not studied sufficiently Dr. Mann's report to say just what effect it will have. We shall not make any attempt to adopt the so-called Cincinnati plan, the good points of which we recognize, but which does not appeal to us as at all desirable for universal application.

4. I think the first part of this question is answered under No. 1; the second part, I suspect, remains to be answered. My own judgment is that professional engineering courses should be based on courses in arts; that the engineeer of tomorrow must have a breadth of education at least equivalent to that of the lawyer or physician.

Columbia University Returning to Former Six-Year Course

By George B. Pegram

Dean of the School of Mines, Engineering and Chemistry, Columbia University, New York

I REPLY as follows on the points suggested in your questionnaire:

1. No useful comment can be made on the influence of the S. A. T. C. on engineering schools without distinguishing between the conception on the one hand and the execution on the other hand. The conception was good, and in a similar emergency we should gladly see it adopted again without any notable change. In actual execution, the S. A. T. C. began by greatly demoralizing the work of our engineering students, but thereafter improved steadily until a fairly satisfactory condition prevailed. The military administration could not suddenly furnish an organization to handle efficiently its side of the educational undertaking. Yet the war has afforded a great object lesson in the astonishing rate at which students can learn under a compelling incentive and inspiration.

Our university committee on admissions made good use of the opportunity presented by the excess of student applicants over accommodations, to make its selections partly on the basis of special tests of mental alertness and of ratings on outstanding personal qualities. The mental alertness tests were prepared by Prof. A. H. Thorndyke on the lines of his tests as applied to Army aviation candidates. The work of the men admitted indicates that these tests were valuable. In this matter of admission requirements it is quite probable that the S. A. T. C. experience will change somewhat our educational viewpoint.

2. We are now returning to pre-war courses without essential changes. Prior to the war we had established three-year professional courses based on admission requirements equivalent to three years of college work, to include mathematics, physics and chemistry, besides the usual college courses in the humanities. This brings these schools into line with our other professional schools of law and medicine. We believe that the emphasis, so evident in the selection of men in the war, on the adaptability that comes from breadth of fundamental training, as contrasted with mere technical expertness, will lead an increasing number of the more able and ambitious students to take up the study of

engineering on the foundation of a sound general and scientific education.

3. We shall find the interesting and suggestive report of Professor Mann a definite stimulus to research in engineering education. At present we are partly in agreement and partly in disagreement with his interpretations.

4. The immediate new needs and opportunities appear to be at the two ends of the scale of technical education. Vocational education should receive a great stimulus. That ship riveters can be trained in two weeks and that bent-shouldered tailors can rapidly become blacksmiths of marked skill, means broader prospects for workers in general, and with the development of schools this vocational education will lead into the elementary types of engineering. The middle ground is well covered by our present engineering schools. Beyond this there is sure to be, on account of the wider outlook of our industries, an increased demand for young men of broader training than the engineering graduate now has. We are trying at Columbia in one way to produce these men, other schools are going about it in other ways, but the product must be had if we are to develop the possibilities of our future in productive achievement.

California Experience Unsatisfactory

By C. Derleth, Jr.
Dean of the College of Civil Engineering, University of California, Berkeley, Cal.

IN MY judgment the influence of the S. A. T. C. upon the engineering colleges was unsatisfactory. Had the war continued the students would have suffered so far as purely engineering instruction is concerned. I believe that the aims of a military school are distinct from those of a civilian engineering institution; the two cannot effectively blend unless one is made decidedly subordinate. The best way to train doctors, engineers and technical chemists for Government service in time of war consists in first educating properly qualified men solely for these respective professions. In each case the course should not be less than three and preferably four years.

When these men have satisfactorily completed a course in medicine, engineering or chemistry, they should then become candidates for Army or Navy service. From these graduate groups men should be selected for military and naval training, but the amount of war training should be a minimum.

In the S. A. T. C. program it was intended to give intensive instruction whereby engineering students in two years would receive the fundamentals that heretofore had comprised a course extending over four years. It is my judgment that such intensive training mixed with military instruction and drill cannot be made effective. There is a limit beyond which the student cannot be driven. Sound growth is always slow growth.

I hope that with the return of peace engineering schools will revert largely to pre-war courses, with only a minimum of modification. Changes are necessary in our engineering curricula to meet new conditions, but these changes must be gradually and judiciously introduced. We must experiment to decide to what extent such subjects as physics and mathematics may be combined effectively with engineering applications, so that the student may study physical and mathematical principles at the same time that he is applying these principles to engineering problems. I think it would be a mistake to carry the combination to an extreme. In the beginning the student must study fundamental principles alone; the complex applications can only be attacked after the student has reached a considerable maturity.

During the past decade engineering schools have been unduly differentiating engineering courses. Too many special curricula confuse the student and tempt him to narrow his fundamental training. I hope that during the next few years our schools will limit the number of different courses offered.

Johns Hopkins University Plans Closer Relation to Practice

By C. J. Tilden
Professor of Civil Engineering, Johns Hopkins University, Baltimore, Md.

THAT at heart America is not a militaristic nation has been rather clearly shown by the experience with the S. A. T. C. During the two and a half months of the S. A. T. C. there was a great deal of friction between the military and the academic authorities in carrying out the requirements issued by the War Department. Educators, realizing the importance of the task under existing war conditions, adapted themselves and their courses to the needs of the Government, only to find that they were materially hampered by the large number of none-too-willing students and by the self-importance and officiousness of half-trained immature youngsters who had been commissioned second lieutenants. A large part of the student body was not of the usual college caliber, and found difficulty in keeping up with the many things demanded of them.

Conditions at the Johns Hopkins University were better than at many other institutions. The question of attendance on classes was settled early by an order of the military authority that the academic work was an essential part of the military training, and that purely military functions must not be allowed to interfere with it. With the chance of fighting in France taken from them, however, there is the almost universal desire on the part of the students to get out of uniform and drop the military training.

The S. A. T. C. of itself will probably have little permanent influence upon the engineering curriculum. The courses in engineering were greatly modified and made more intensive during the emergency, the program put out by the Education Committee of the War Department having been adopted practically in its entirety. This is not at all satisfactory, however, as a permanent basis, and will be relegated to the scrap heap just as rapidly as the transition can be made.

Nevertheless, many modifications of the pre-war courses are being seriously considered and will probably be adopted. In view of General Black's strong emphasis on the need for more training in descriptive geometry, the number of hours devoted to this subject will be increased, with more attention to practical

applications. The study of Spanish instead of German will be encouraged, in order to meet the demand of growing opportunities in South America. Coöperative courses, such as those offered at the University of Cincinnati, are being planned by the mechanical engineering department, and the idea receives a favorable response from industries in Baltimore. There is a new and vital need for trained organizers, and courses must be worked out to develop men to meet the practical requirements for quantity production, which will be paramount in the next few years.

Dr. Mann has given valuable suggestions in his "Study of Engineering Education." One result of the study of this report is that more emphasis will probably be put on the "project" system in teaching. It is hoped to develop this idea along the lines of the architectural problem in design or construction, with its carefully worked out schedule or program of requirements. In some ways this method is, of course, similar to the "case" system which has proved so successful in law schools.

Many Consider Experience as Disastrous

By Anson Marston
Dean of Engineering, Iowa State College, Ames, Iowa.

AS I HAVE just returned from continuous service as lieutenant colonel of engineers in the Army since July, 1917, I have had no direct experience with the S. A. T. C. However, I have had opportunity to obtain personally the views of a considerable number of representatives of the principal engineering schools of the country, as well as to observe the situation at this institution. I would answer your questions as follows:

1. The experience with the S. A. T. C. at the engineering colleges has been little short of disastrous. Its effect has been to arouse—for the moment, at least—intense opposition to everything military. This feeling is so widespread among the patrons of the colleges as well as the college authorities that I fear it may have a disastrous effect upon the decision of the country as to the adoption of universal military training, which I personally favor.

2. The return to peace conditions will not mean a probable return to pre-war courses without modification. The effect of the war has been to disrupt the colleges completely. The authorities propose to take advantage of this situation to make desirable improvements, many of which they have been debating for years previous to the war. Changes will be decided upon between now and the opening of the next college year.

3. As to the "suggested solutions" by Dr. Mann in his report, they are under consideration, with other possible improvements, but nothing is finally decided as yet.

4. Post-war conditions will call for much bigger and broader engineers. This country is now a world power, and must extend her manufacturing, shipping, and financial interests all over the world. This will demand engineers of the biggest caliber and broadest training. Nevertheless, I feel that general engineering education, in meeting the new conditions, will be simplified rather than made more complex. It is so manifestly impossible to train every engineer in a predetermined specialty which will meet the demands upon him in his professional work that it seems to me probable that we must give the engineer a very thorough and broad training, and provide special schools of high technical character to which practicing engineers may come back for special training after they have determined their specialty by actual experience.

Princeton May Return to Four-Year Course

By F. H. Constant
Head of the Civil Engineering Department, Princeton University, Princeton, N. J.

IT IS RATHER early to answer your four searching questions upon engineering education, but we are giving the subject careful consideration.

1. Academically, the influence of the S. A. T. C. was negative. It is too early to learn what permanent influence military discipline has had upon the student mind, but it has at least been shown that the student is capable of much more intensive effort than he was encouraged to make in the past. The colleges, on the other hand, are awakened to a new conception of service. There is no reason why any man should not be permitted to pursue courses in college for which he is prepared, whether they lead to a degree or not.

2. We shall continue the three-year course for sophomores and juniors, including a nine weeks' term next summer. We may return to the four-year course for the present freshman and subsequent classes.

3. We are making a careful study of Dr. Mann's report, and may embody some of his suggested solutions in our plans. In particular, should we return to the four-year course it will be with the expectation that some system of coöperation with the engineering industries during the vacations can be put into effect. This would be the most potent reason for returning to the four-year course.

4. The war has developed a greater appreciation of the value of an engineering education. The engineering schools will undoubtedly have more students than ever before. It is the duty of these schools to keep in closest touch with the new needs created by the after-war conditions, in order that they may fulfill their highest service at this time.

Experience at Northwestern Emphasized Value of Discipline

By John F. Hayford
Director of the College of Engineering, Northwestern University, Evanston, Ill.

THE short experience of the colleges of engineering of the United States with the S. A. T. C. was an incomplete experiment, conducted under circumstances extremely unfavorable to educational success, and brought to an untimely end by the abject surrender of the Germans.

That experiment has started new lines of thought in the minds of engineeering educators, and has greatly increased the vigor with which all suggestions for improvement are studied. It has furnished suggestions only, not solutions—and some of the suggestions are clearly negative, indicating methods to be avoided.

The experiment, and to a much greater extent the whole war experience, have put forward two old ideas so strongly and clearly that improvement is reasonably sure to follow. The ideas are (1) that strong motivation leads to rapid and permanent progress on the part of the learner, and (2) that discipline leads to better performance of the whole man, including his brain.

The embryo officer in a training camp, with a clear picture in his mind of the part which it might become possible for him to take in the greatest single piece of work civilized people have yet undertaken, was so motivated that he learned at a rate that was astonishing, and later performed accordingly if the opportunity came to him. How can we secure some considerable fraction of such a motivation in our students of engineering? It must be secured, if that is possible. Can it be secured in part by showing the student early in his college career what engineering is, how essential it is to our present civilization, and how the apparently abstract parts of his early studies—in mathematics and physics, for example—are related to his possible success as an engineer?

Discipline which leads each man to coöperate with every other man in the group in such a way as to secure the maximum effectiveness of the group in accomplishing the purposes which are common to ali also leads to development of the individual, including his brain, and even that indefinable part of him which gives courage, initiative and automatic habits which make hm a better man. Discipline is objectively most highly developed in the military form, and its direct effects are most obvious.

The war has emphasized the need of more and better engineering education rather than of a radically different engineering education.

It is too soon to expect the conclusions of the Mann report to be embodied in action. But, just as the valuable, permanent effects of the war on the methods of engineering education are still in the future, but sure to come, so also are the similar effects from the Mann report.

No Definite Changes Yet Decided Upon at New York University

By Charles H. Snow
Dean of the School of Applied Science, New York University, New York City

IT SHOULD be remembered that the S. A. T. C. is made up of two parts: Sections A and B, otherwise known as the academics and the vocationals. It seems to me that when commenting unfavorably, as many do, upon the work of the S. A. T. C. the tendency is to forget the participation of Section B. We regarded the work of the New York University Section B as very successful.

1. There was no constructive influence exerted by Section A upon the work of the School of Applied Science of New York University. The experience with Section B has intensified the feeling of many that certain men may not learn at all readily from books, and yet learn with surprising readiness "by doing."

2. I do not think that the return to peace will mean a return to pre-war courses without essential modifications, but I cannot yet tell what the changes here will be. Thus far it is a case of "we don't know where we are going, but we are on the way."

3. We have not yet embodied in our plans any of the suggested solutions brought out by Dr. Mann in his admirable paper. The experience is too recent; the matter is too important for quick action. We shall conclude this year on last year's program, save that the spring term will continue over into the summer. Changes will be announced for next autumn.

4. The importance of the engineer and his education has been greatly increased by the war. To say the least, this importance will not be diminished by the reconstruction period. The field suggested by your question is very large. At this writing, I can make no other direct reply than to say that the new needs and opportunities in engineering and engineering education developed as a result of the war will be very great indeed; I cannot detail.

Minnesota to Modify Surveying Course

By John R. Allen
Dean of the College of Engineering and Architecture, University of Minnesota, Minneapolis, Minn.

ANSWERING your questionnaire in regard to the effect of the S. A. T. C. at the University of Minnesota, I would say:

1. In the collegiate section of the S. A. T. C., we conducted our surveying classes all day long from 9:30 a.m. to 4:30 p.m., the students eating their luncheons in the field. This method we found very effective and satisfactory, and we shall probably continue it, although we have never done it before. This is the only class in the college which was better conducted during the S. A. T. C. than in the ordinary period.

2. There will be no substantial changes in the courses taught our students, as engineering is just the same now as it was before the war.

3. Dr. Mann's suggestions in his report were in most cases not new, and had already been considered in most engineering schools. We are making some changes in the teaching of mathematics, as we have added laboratory hours to these courses. We are also making some changes in the teaching of mechanics and physics. These changes were contemplated, however, before the publication of Dr. Mann's report.

4. I believe the opportunities for engineering education and for the engineer will be greater than before the war, due to the prominence that has been given to engineering during the war. I do not believe the needs in the engineering profession will be substantially different after the war than they were before.

Harvard Sees Need for Fundamentals

By H. J. Hughes
Professor of Civil Engineering, Harvard University Engineering School, Cambridge, Mass.

YOUR questionnaire has been referred to me for reply. The absence of many of our staff makes it impossible to give you anything but a personal opinion, which follows:

1. I am convinced of the folly of attempting to make students do the impossible, and the importance of suitable methods of selecting men for certain duties was

forcibly shown here. I have long believed that the entrance requirements now in vogue are defective, yet the recent experience has demonstrated their merits. Students in the S. A. T. C. showed distinctly less ability than our average, in spite of the fact that much of the work was less academic than usual. The best thing about the S. A. T. C. was the fine enthusiasm shown by many of the boys for any work whatever when they thought it brought them nearer active service in the war.

2. A return to peace will probably not mean a reversion to pre-war courses without essential modification, but the changes are likely to be gradual. The S. A. T. C. did not last long enough to upset traditions, and in framing its engineering programs a great opportunity to discourage needless differentiation was lost. It seems likely that certain methods of intensive training used successfully in the officers' training camps will be continued. More emphasis will probably be placed upon fundamental subjects, less upon temporary standard practices.

3. This school is being reorganized as the result of a court decision to the effect that a coöperative agreement made with the Massachusetts Institute of Technology is illegal (see *Engineering News-Record* of Dec. 26, 1918, p. 1198). The present year will be chiefly devoted to meeting the varied needs of students returning from service. Dr. Mann's report is of particular interest to us, but it is too early to say what solutions suggested by him will be embodied in our courses. Our students will have opportunities to take courses in the college, in the business school, and in other departments of science. We mean to plan for specific coöperation with the industries at some time and in some way over a considerable part of our programs. We expect to study the Cincinnati plan as an outstanding, successful experiment.

4. The new needs appear to arise from increasing demands for young engineers who are thoroughly grounded in science and capable of solving new problems at first-hand. The importance of training in fundamentals has been emphasized for years, and yet some of the most glaring defects in engineering education continue to be perpetuated. Most engineers realize that the fourth year and often the third are padded with so-called professional subjects, superficial in themselves, and valuable chiefly as advertising matter. Now the schools have an opportunity to face the facts honestly, to break with old habits and prejudices, and to provide the kind of training we know to be needed.

Unusual Features in Willamette River Bridge at Salem, Oregon

Timber Floor With Asphalt Wearing Surface—Pony Truss Span Supported by Cantilever—Arched Struts Used

By Lewis W. Metzger

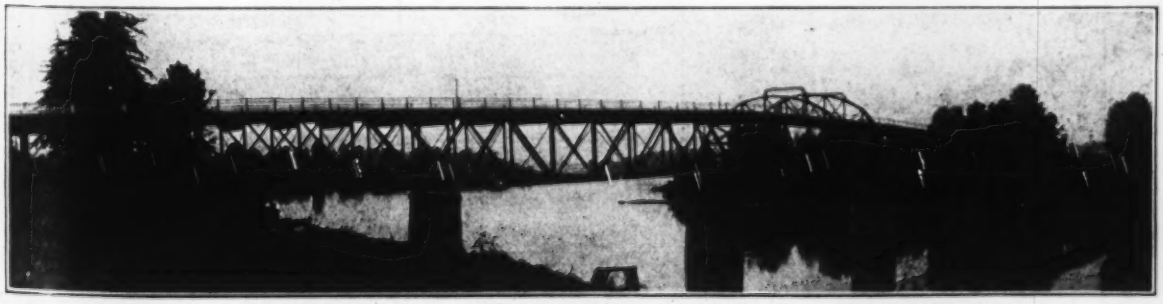
Designing Engineer, Oregon State Highway Commission

Probably the longest highway bridge built recently is that over the Willamette River at Salem, Ore. It replaced two 360-ft. steel spans, erected in 1890, which were too light for the heavy modern traffic recently developed on this main highway through the Northwest. Several special features distinguish the design of this bridge, a composite structure with a reinforced-concrete approach on one side, a timber trestle approach on the other, and deck steel truss spans with a pony truss span 123 ft. long supported on cantilever arms to give the requisite clearance requirements. Curved latticed struts connect the trusses of the pony span. The floor throughout is built up solid of 3 x 7 fir members on edge, carried by steel stringers and by the top chords of the deck trusses, with a wearing surface of asphalt 3½ in. thick.

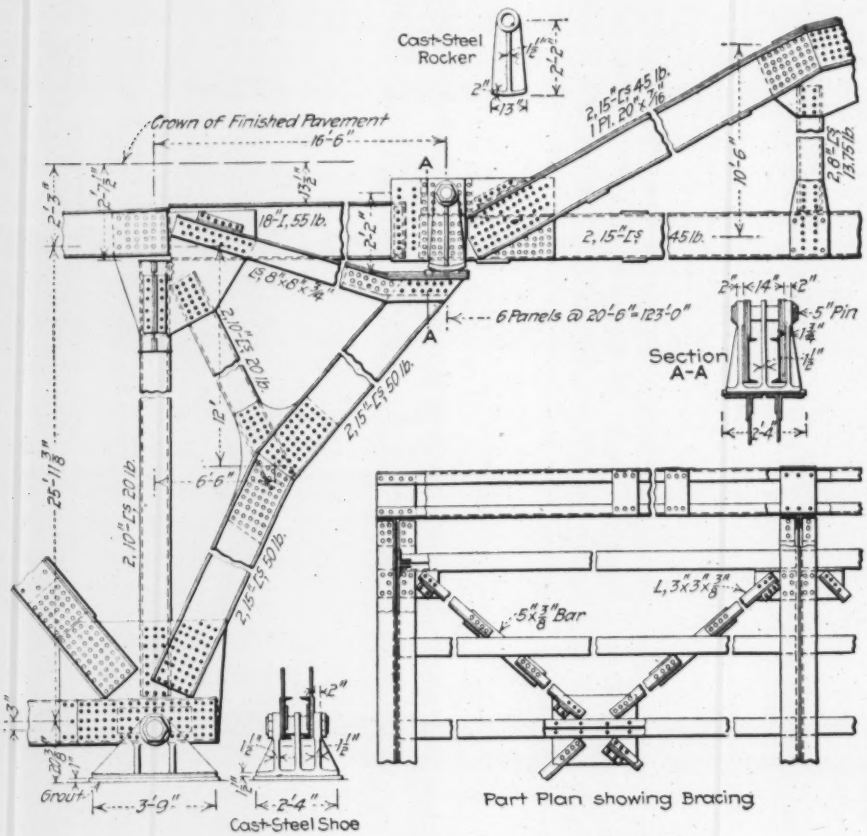
This design is the same as that described in *Engineering News-Record* of Nov. 8, 1917, p. 876, and was originally outlined by Joseph Weare, assistant state engineer. It consists of a pile trestle approach 780 ft. long on the Polk County side, four steel spans of the same length (152 ft. 3 in.) a single pony truss span 123 ft. long carried on cantilever supports from the adjacent spans, one shorter steel span (111 ft. long) and a reinforced-concrete approach 352 ft. long on the Marion County side. As the Willamette River is navigable at this point, United States engineers required a minimum horizontal clearance of 120 ft. and a vertical clearance of 66 ft. By the pony truss and cantilever design a clear opening of 145 ft. was provided.

The west approach follows a modern design of timber pile trestle type. The fir piling was treated in an open vat with carbolineum at a temperature of about 220 degrees Fahrenheit.

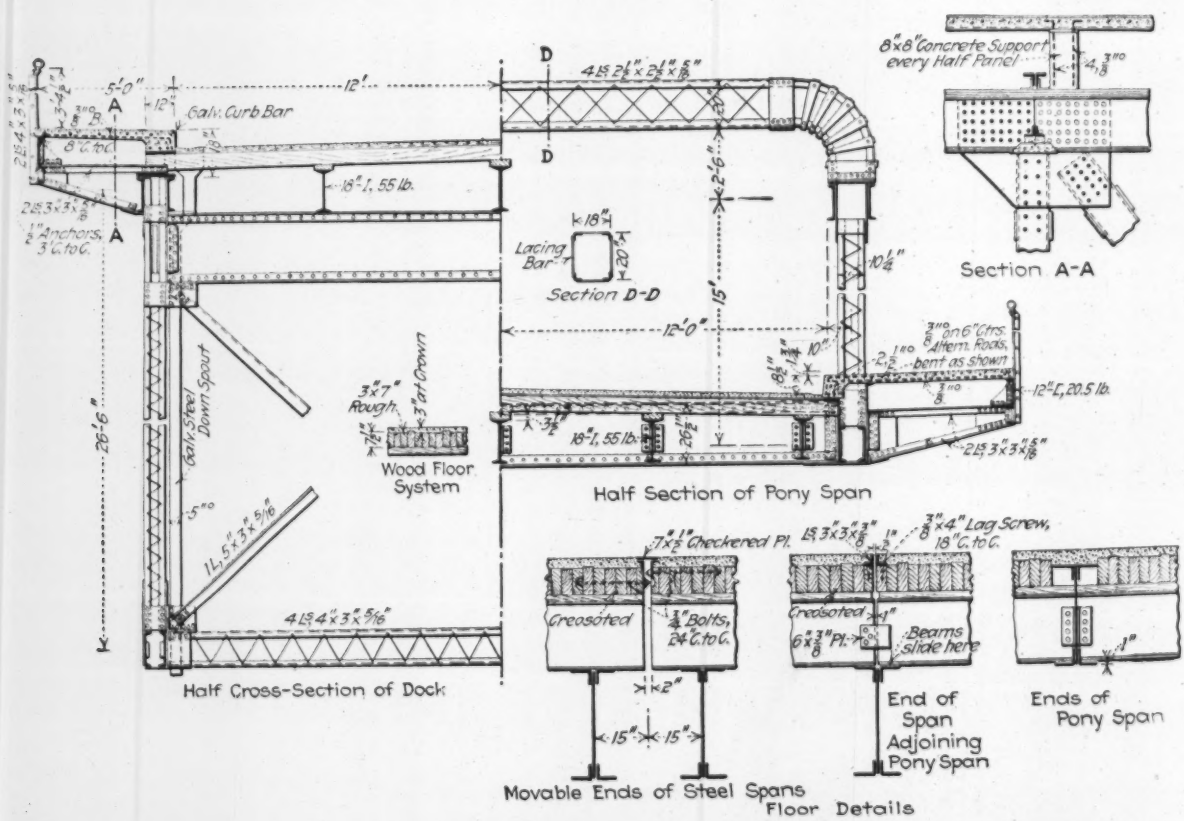
Lumber being comparatively cheap, the entire roadway deck of the bridge and wooden approach is com-



WILLAMETTE RIVER BRIDGE AT SALEM HAS PONY TRUSS SPAN SUPPORTED BY CANTILEVERS



posed of 3 x 7 in. x 26 ft. laid on edge, spiked together and thus projecting 1 ft. on either side of the 24-ft. roadway. An asphaltic wearing surface 3½ in. thick effectively waterproofs the wood, and the small interstices between the pieces will allow sufficient circulation of air to preclude any possibility of attack by dry rot. The ends of the floor members were painted with hot carbolineum, as were also the wooden members contiguous to openings in the floor caused by expansion joints between the spans. The steel span adjacent to the east approach is not so deep as the adjoining one, and the difference in height is made up by means of a rocker which, of course, also serves the purpose of movable shoes. The channel span of the pony-truss type rests on cast-steel rockers on one end, each of which are carried by a shelf on the cantilever panel, projecting from the adjacent steel deck truss



UPPER—DETAILS AT EXPANSION END OF PONY SPAN. LOWER—TYPICAL CROSS-SECTIONS OF STEEL SPANS—FLOOR DETAILS AT EXPANSION JOINTS

span. The details of the movable end of this span are shown in one of the accompanying drawings. The other end of the span was pin-connected to a built-up shoe.

For the sake of economy it was decided to design the upper chords of the deck spans to serve as outside floor stringers, thus taking bending as well as direct compression. Wooden sleepers were bolted at intervals to the top chords, to facilitate the attaching of the wooden flooring. The typical cross-sections shown in one of the accompanying drawings indicate the nature of the details connecting the floor system with the steel trusses of both the deck and pony types.

The two 5-ft. concrete sidewalks are carried on brackets beyond the trusses, the curbs serving as reinforced-concrete beams. Small concrete struts extend up from the top of the top chords at the panel and mid-panel points. Between the bottom of the curb and the top of the wooden floor is a ¾-in. cushion of "Sarco." Owing to the grade of the bridge, it was necessary to precast this in sheets the width of the curb. When the material hardened it was rolled up in convenient lengths and placed.

It will be possible to renew the wooden floor with comparatively little difficulty, although it is believed that the wooden floor base, protected as it is, should last at least 50 years.

The final coat of battleship gray paint applied to the steel work has evoked favorable comment, being an innovation and a change from the black commonly used.

The cost of the crossing complete was about $250,000. The engineering cost was remarkably low. Including the surveys, borings, inspection of cement and steel fabrication, the resident engineer's salary, the cost of design, blueprints and supplies, and stenographic work, it amounted to $4600, or about 1.8% of the total cost.

The bridge was built by the Coast Bridge Co. and Robert Wakefield of Portland, Ore.; Charles McDonald was superintendent. The engineering work was done by the Oregon State Highway Commission. Herbert Nunn is state highway engineer. The writer was designing engineer.

Conserving City Water-Supplies in Southeastern Kansas

Recent Dry Seasons Resulted in Draining Natural Pools and, for More Permanent Results, in Formation of Reservoirs

By F. M. Veatch
Engineer, State Board of Health
AND
Professor F. N. Raymond
University of Kansas

THE severe drought in southeastern Kansas during the past two seasons has caused the working out of a fairly definite plan for conserving the water-supplies of the towns in that district. The city officials and the consulting engineers who have had most to do with these water-works plants, together with the state engineering departments, have been working not only to relieve present shortages, but also to safeguard the future and at the same time help toward a better use of the water resources of the whole district. These notes will describe the measures taken to increase and utilize stream storage.

Southeastern Kansas is not especially dry as compared with other parts of the prairie states, its mean annual rainfall, as calculated by the United States Weather Bureau, being above 35 in. The population is fairly numerous, however, and the people are largely engaged in mining and in oil and gas producing and attendant industries. There are some 50 towns of from 1000 to 20,000 population. Most of these have water-works systems that in ordinary times are very satisfactory. But these systems have usually been built in the first place mainly for fire protection, and the demands of communities growing both in population and the varied uses to which water is put have made the supplies more and more inadequate.

The recent drought was the severest on record. In the 20 months from January, 1917, to August, 1918, the rainfall was a little more than 60% of what is normally to be expected in these months. The water-supply ran low in the summer of 1917, but no great suffering was caused; the situation improved during the winter, but by June, 1918, many of the streams quit running, and the approach of the annual dry season caused much anxiety. In July service had to be restricted to domestic use in some towns, in order to prevent actual suffering. Railway supplies at city plants had to be cut off, and the shipping of cattle out of the country began. The trouble increased steadily until the latter part of August, when the rains began.

The surface water-supply for this district comes from the catchment areas of the Marais des Cygnes, Neosho, and Verdigris Rivers and some minor streams. The run-off varies from 0 to 13, and averages 0.4 to 0.5 sec.-ft. per square mile. The engineering problem, practically, is to provide storage reservoirs for water enough to last through a possible two years of drought.

Plenty of water is always to be found in the pools of the rock-bottomed Neosho for the small towns along the lower part of that stream. In other places, however, as along the Verdigris and the Marmaton, where the stream beds are soft, alluvial material, the natural pools cannot be depended upon. Generally, too, the flat country and the shallow channels of the streams do not afford good sites for large reservoirs.

The means for combatting the drought have heretofore depended almost altogether upon the conditions at each place at the time of shortage. At Cherryvale, for example, where the water is taken from the Verdigris River, ditches were cut from pool to pool in the river bed, and the contents of the pools all drained down to the reservoir at the city plant. But these ditches destroyed the storage value of the pools for the future. At Independence and Coffeyville, the largest towns in the district, similar ditching was done with similar results, also at other places.

In case pumps or siphons are used to convey water from pool to pool, the cost of obtaining and operating the extra equipment is often excessive—in fact, in some cases the cost of the work for a single dry spell has wiped out the profits of the plant for a year or more.

The logical development of the plan has been, therefore, to build dams at the points where the rock out-

croppings forming the pools occur. Such dams have valves so located that the water stored in the pools above them may be made available at will. Usually, a series of small dams is better than one large dam, for the small dams cause less trouble in case of flood.

The following cities have built or are building dams on this plan: Fort Scott, Neodesha, Eureka, Cherryvale, Independence, Coffeyville, Lyndon, Ottawa, Garnett and Cedarvale. The Verdigris (including its tributary, the Fall River) will be almost a continuous series of these storage reservoirs for many miles.

From the studies necessary in these cases, data are being gathered to supplement the general survey of surface-water resources in the district.

Balanced Rations and Good Cooks Cut Cost of Camp Messes

Investigation of Spruce Production Board Engineers Show 30 Per Cent. of Avoidable Food Wastes—Simple Meals Satisfy Workmen

BALANCED rations and good cooks will reduce food wastage in construction camps. This conclusion is arrived at by an analysis of mess practice in the lumbering industry, made by Capt. Thorfinn Tharaldsen, Spruce Production Board, Bureau of Aircraft Production, United States Army. Four principal kinds of waste exist: In buying, in storage, at table and at plate. Unbalanced rations, extravagant menus, improper storage and poor accounting are the causes of these wastes. They amount in the lumbering industry of the Northwest to from 20% to 30% of the total of foodstuffs purchased.

Table Wastes Largest Item of Food Wastes

Too great a variety and too large quantities of food are prepared for each meal. Using the mess as an indirect method of attracting labor is often the reason for this extravagance. The remedy is the adoption of a standard ration list and a simple menu. A suggested ration list is given in the accompanying table. No more than one meat and one dessert should be served at any one meal. Further specification of menus is impracticable, since proficiency of the cooks, tastes of the men, accessibility to markets, season, market conditions, etc., determine the bills of fare at different times and places. Adoption of a system of monthly or bimonthly reports will aid in regulating the rations. A proper report form will show at a glance whether or not too much food is being used, which kinds are being used to excess, and whether the ration is well balanced.

Single meat and dessert menus are the solution of the problem of table waste. Meat and vegetables should be prepared only in such quantities as will probably be consumed at one meal. Meats, when placed on platters for serving, if cut into smaller pieces will permit the man to take as many portions as he may wish, but will not encourage him to take more than he can eat. Waste of leftover food can be reduced by skillful cooking which permits reservice in appetizing forms, as mentioned later.

Plate waste is due to men placing more food on their plates than they can possibly eat. This is generally due to one of four causes: Too large portions placed on the serving platters; natural hoggishness of men with keen appetites; food sabotage, and unpalatability. The greatest waste is due to the first cause.

SUGGESTED DAILY RATION LIST FOR CONSTRUCTION CAMP MESSES

	Pounds per Man per Day	Pounds per 100 per 90 Meals
Meats, fish	1.25	37 50
Eggs	0.156	4 68
Lard, etc	0.08	2 4
Butter and substitutes	0.15	7 5
Cheese	0.05	1 5
Milk, canned	0.25	7 5
Milk, fresh	1.00	30 00
Beans	0.125	3 75
Potatoes	1.00	30 00
Peas	0.10	3 00
Corn	0.10	3 00
Tomatoes	0.10	3 00
Onions, carrots, parsnips, etc	0.125	3 75
String beans, asparagus, etc	0.062	1 86
Sugar (all purposes, baking, cooking, table, etc.)	0.20	6 00
Syrup and molasses	0.25	7 50
Jams and jellies	0.031	0 93
Flour (all kinds)	0.90	27 00
Oatmeal	0.10	3 00
Cornmeal	0.02	0 60
Cornstarch	0.02	0 60
Rice and barley	0.02	0 60
Dried and canned fruits	0.25	7 50
Fresh fruits, etc	0.25	7 50
Teas	0.01	0 30
Coffee	0.071	2 13
Total	6.670	203.10

Plate waste can be largely eliminated by serving smaller portions and repeating the servings as the men ask for more. Instead of shortening the meals by "no talking" rules, encourage the men to lengthen the meal time. A personal appeal to the men not to waste food is effective if reduction of waste is accompanied by an immediate and corresponding reduction in the price of board. Food sabotage can be corrected only by punishment; observation shows very little malicious and intentional destruction of food in camp messes. A fourth remedy is to insist upon palatable food; this is a matter of getting good cooking, as is discussed later.

Storage and Buying Wastes Easily Corrected

Buying foodstuffs is often put into the hands of someone who has little skill in balancing rations and in forecasting conditions. Often food is bought ahead for a gang of 50 men, when in the following month the gang may be reduced to 35 men; or a surplus of one kind of food is bought and not enough of another kind. Divided authority to purchase is another fault causing duplication of purchases, one by the camp cook and another by someone at headquarters. The remedy is to centralize buying authority and to educate the buyers in scientific catering.

Waste in storage is due chiefly to lack of cold-storage facilities. Some form of cold-storage apparatus in every camp of 50 or more men is a profitable investment. Another cause of storage waste is inadequate protection from destruction by rats, mice and other vermin.

A good, practical camp cook is the most valuable man in the camp, and his services should be properly recognized. Such a cook can save many times his wages in foodstuffs, and he is also a very important factor in the labor situation at his camp. It is a universal rule that men well fed will endure great hardships without grumbling. An incompetent cook will invariably mean

a full garbage bucket. He will waste many times his wages in food destroyed. Even the best quality of foodstuffs loses its value if improperly prepared by an incompetent cook. Such cooks are directly responsible for no small part of the wastage in the camp mess.

A good camp cook is cheap at almost any price, and an incompetent one is expensive, no matter how small his wage. A camp cook works long hours. From 4:30 a.m. to 8:30 p.m., seven days in the week, is a fair average. When his legs give out, he is accused of having "gone stale on the job," and his services are dispensed with "for the good of the service." It would seem wise to arrange to give each cook a short vacation, on full pay, at stated intervals.

Meat and potatoes should be served in different styles and varied in kind from day to day. Men have an inborn antipathy for "hash." Leftover meats should be re-served in form of stews, "mulligan," meat pie, etc., preferably with the addition of suitable quantities of fresh meats. Leftover meats and vegetables should be re-served in some form within 24 hours. Special care must be taken to see that no tainted meats or soured vegetables are used as an ingredient in any stew, meat pie, etc. No foodstuffs whose quality is questionable should be served under any circumstances. The meats should be properly washed and trimmed before they are prepared.

Frequent changes make all food more appetizing, and special attention must be given to the rotation of the different foods of the same kind. For instance, potatoes served mashed at every meal become tiresome, while if served baked, fried, boiled and mashed in rotation they are very palatable. A steady beef diet loses its attraction in a short time, while if the meat diet is made up of beef, pork, mutton, fish, etc., in rotation, with beef preponderating, this will not occur.

The success or failure of any meal depends largely on the manner in which it is served. Careless, sloppy service will ruin the best prepared meals. Everything should be neat and clean; meals must be served promptly, and dirty dishes removed quickly and quietly. Sloppy service will upset a camp as quickly as it will a hotel. Complaints should be made privately to the person in charge and not to cooks or waiters, and prompt investigation and adjustment of the matter should follow.

What Part the Engineer Played in Government Housing

Report of Chief Engineer of the United States Housing Corporation Outlines Work of His Division

ENGINEERS in general are not too conversant with the part they can play in housing developments. For their information there is printed below a large part of the report of John W. Alvord, the Chicago consulting engineer who was chief engineer of the United States Housing Corporation. Mr. Alvord's report outlines the work of his division in the construction of the many housing projects undertaken by the Department of Labor under a $60,000,000 appropriation. The signing of the armistice cut off the completion of most of the projects of this bureau, but the engineering work made up a large portion of the preliminary operations.

Mr. Alvord's report follows:

The Engineering Division of the United States Housing Corporation was early formed because the proposed Government housing is principally conducted in cities, or closely adjacent thereto, and it became necessary to obtain the aid and advice of engineers familiar with municipal and public utility work to plan and supervise these improvements and make the necessary arrangements with the municipalities in which they were operating, and also to contract with utility companies whose service was needed.

Extent of Housing Undertaken

The work has included the planning and negotiation for the extension of municipal improvements, such as drainage, sewerage, water-supply, electric light, fire-alarm systems, fire protection, gas, sidewalks, gutters, street paving, street lighting, sewage-treatment plants, pumping stations and other municipal improvements.

In connection with the housing bureau program, 60 or more developments projected in various parts of the country have reached the stage of engineering planning. These range all the way from 25 to 3000 families per development, and there have been necessarily planned for this work in the aggregate the following municipal improvements:

180 miles of sewer, costing about $2,852,700.
160 miles of water pipe, costing about $2,672,600.
11 independent pumping stations for water-supply.
83 miles of gas lines, costing about $637,700.
145 miles of eleteric transmission systems, at $775,000.
135 miles of street paving, curbs and gutters, costing $3,060,300.
260 miles of sidewalks, $1,234,300.
2877 street lights.
6 sewage-pumping plants.
13 sewage-treatment plants.

The total cost of all contemplated municipal area utility improvements will approximate $13,060,000.

The necessity for working in coöperation with the municipality in which the development is situated has necessitated negotiation with over 60 mayors, city councils and city engineers as to the inter-relations of the bureau with the municipality. In each case it has been urged upon the city that it is their privilege and duty to assist the bureau, as far as possible, by doing for the Government at least what would usually be done for a private individual making a similar investment. In many cases more than this amount of aid has been sought, and in some cases generously extended.

In some cases the inter-relations with municipalities have necessitated loans; in other cases complex special assessment relations; often aid to the city in urging permission for the issue of securities by the Capital Issues Committee; and, nearly always, obtaining priority orders for material and negotiating regulations made by the War Industries Board for emergency exclusion of expensive materials, difficult to obtain in the view of other war demands, and the adaptation instead of local materials.

For this purpose the Engineering Division has, of necessity, been largely composed of municipal engineers, especially skilled in municipal work, assessment law, city regulations, precedents and practices. The Engineering Division, through its negotiations, has obtained aid

from municipalities to the extent of $3,103,000 or 24% of the total cost of the total utility and municipal work contemplated.

The Engineering Division has further been entrusted with the negotiations with private utility companies for the necessary service for the bureau developments of gas, electric lights, water-supply, and, in some few cases, of heating facilities and telephone service as well.

In all some 250 negotiations have been conducted, a large portion of which have been brought to a successful termination. In many instances it has been necessary to come to the assistance of utility companies which were financially embarrassed, yet whose continued service was essential to the development and the Government in adjacent war industry. In these cases, a financial adviser, skilled in utility securities and banking, has reported carefully upon the financial ability of the company, and its ability to furnish necessary collateral. Where good banking loans could be had, the utility has been financed through approval of the Capital Issues Committee. In cases where good banking loans are not available, utilities have at times been financed by the bureau direct, making the loan upon such collateral as was available.

In every case, it has been urged upon utility companies that they ought to accord the bureau the same service, if not more service, than they would accord a private investment under similar circumstances. The necessity of the situation has required contract relations or negotiations with 48 gas companies, 67 electric companies, and 40 water companies, or about 150 utility companies in all.

The Engineering Division, through its negotiations and efforts, has obtained aid and financial investment from utility companies for United States housing to the extent of $1,600,000, or 12.3% of the total cost of utility investment. The total amount raised by suggestion and negotiation of the Engineering Division from municipalities and utility companies for United States housing requirements has been $4,702,700, or 36.2% of the total requirements of $13,040,134, estimated utility expenditure. Of the $4,702,700 raised from municipalities and utility companies, about one-half, or $2,216,900, has been financed by the municipalities and utility companies, and the remainder loaned them by the bureau, to be repaid to the Government in the near future.

Preliminary Investigations

The Engineering Division has been employed in making preliminary investigations for the bureau in connection with the selection of local sites for housing developments. This matter, almost always difficult to determine, has been handled by a committee consisting of an engineer, an architect, a realtor and town planner, and in each case all sites offered or suggested have been carefully canvassed, their development cost estimated, and the selection made on the basis of actual desirability regardless of all private interests.

The Engineering Division at the central bureau consists of a chief engineer, an engineering secretary to the chief, a chief assistant, 10 district engineers (each of whom has conducted the individual details of a group of projects), two utility engineers, one road engineer (lent by the Bureau of Roads and Rural Engineering), one fire-protection engineer (lent by the National Board of Fire Underwriters), two electrical engineers, an attorney on contract relations, and an engineer in charge of engineering contracts, bills and accounts, and four stenographers—about 25 in all.

Organization of Engineering Division

The duties of the central staff have been:

1. To prepare a manual of standard directions for local project engineering designers, and
2. Standard instructions, drawings and specifications and directions.
3. To act as adviser to other divisions on engineering questions.
4. To report on all unusual or difficult engineering problems, such as constantly arise.
5. To select, appoint and contract with all local project engineers and their assistants.
6. To guide and direct the local project engineers.
7. To revise the budget allowance in accordance with the policy of the bureau.
8. To initiate and conduct all contract relations with city and utility companies.
9. To approve all detailed plans, estimates and specifications of such local project engineers and control their operations.
10. To check the bills of material.
11. To advise the town-planning and construction divisions on all engineering questions.

In the field some 60 local project engineers have been appointed who have been either persons or firms having locally efficient office, organization, acquaintance, equipment and financial ability in addition to specialized training in municipal problems, and who could do rush work on short notice in the preparation of plans, conducting negotiations and the supervision and construction of local development projects. Contracts with the local project engineers have been on a uniform contract form prepared by the Engineering Division, and based on a scale of fees less than ordinarily earned but thought to be sufficient, in which all contracting engineers have been uniformly treated alike. The fees and overhead expenses have been on a sliding scale, reducing in cost per house with the increase of the development, and prepared on the basis that the municipal improvements would vary approximately with the number of houses in each development. The average of fees and overhead allowance has been but 1% on the cost of utilities involved, amounting to about $2500 on a 200-house development, and increasing to about $4500 on a 1000-house development, in addition to which the project engineer received actual cost for his assistants, the traveling expenses and such obvious expense as could be readily checked by the fiscal division.

Oil Production Gains Three Per Cent Over 1917

A gain of 3% over the record production of petroleum in 1917 is indicated in the preliminary estimate for 1918. An estimate of nearly 350,000,000 barrels, as against the record for 1917 of over 335,000,000 barrels, is made. The reserve of crude oil held by all producers and pipe-line companies in the United States at the end of 1918 is estimated at 123,000,000 barrels, as compared with 150,000,000 barrels at the end of 1917.

ENGINEERING LITERATURE

A REVIEW OF BOOKS AND A LISTING OF NEW PUBLICATIONS

Flow of Water in Open Channels

REVIEWED BY ROBERT E. HORTON
Consulting Hydraulic Engineer, Albany, N. Y.

CALCULATION OF FLOW IN OPEN CHANNELS—By Ivan E. Houk, Assoc. M. Am. Soc. C. E. Technical Reports, Part IV. The Miami Conservancy District. Dayton, Ohio: The District. Paper; 6 x 9 in.; pp. 283; illustrated. 75c.

More perhaps than any other branch of engineering, hydraulic science has received numerous contributions during recent years, in the form of elaborate technical reports. Dating back to the monumental United States Deep Waterways Report of 1898, and running through the series of reports on the New York water-supply, the New York Barge Canal, and others, later, resembling these prototypes, there has probably been none which contained so much in the way of definite contributions to hydraulic theory and practice as the series issued by the Miami Conservancy District, of which the work under review is one.

Apparently, the title might better have been "Formulas for Flow in Open Channels," as the book is devoted almost entirely to a discussion of numerous formulas for flow in open channels and the presentation of experimental data to test the accuracy of these formulas. There is a great deal of technic to the calculation of flow in open channels that is quite apart from the formulas used and is not gone into in this book, except as it is involved incidentally in the computation of experiments here recorded.

By way of clearing the ground of minor criticisms, it might be noted that formulas in which the exponents of the hydraulic radius r or the slope s have values other than one-half as in the Chezy formula are here referred to as "exponential formulas." The term "exponential formula" has a definite meaning in mathematics, and refers to an expression where the exponent is a variable. That is not true with regard to these formulas. Furthermore, the Chezy formula is as much an exponential formula in the sense of the term used in this book as any of the others. It is true that this loose terminology has been used before. What is meant is that the exponent of r or s or both is not one-half as in the Chezy formula. The various formulas referred to are all special cases of a general nth-power formula.

The formula devised by the Swiss engineers, Ganguillet and Kutter, is often referred to here, as it is elsewhere, as Kutter's formula. Failure to give Ganguillet equal participation in the credit appears unjustified even on the plea of abbreviation, but the practice is probably too well established to be easily changed.

The book contains calculations of maximum discharges in the flood of 1913 in the Miami Valley, using Ganguillet and Kutter's formula with coefficients of roughness checked by special experiments on reaches of the same or similar streams. This part of the book affords convincing proof that reasonably reliable and satisfactory determinations of flood discharge can be obtained in this way, and the manner in which the work was done and is described in the book is wort of commendation. Incidentally, a method of calculatin discharge from the drop in the water level during floods in passing through contracted bridge openings is described. Such methods are often needed, and the one presented here will probably find useful applications.

To most hydraulic engineers Chapter IV, containing the results of some 84 experiments for the determination of the coefficient of roughness in natural river channels, will be of great interest and value. Details of the experiments are given in full, with descriptions of the character of each river reach on which experiments were performed. These descriptions are accompanied, in several instances, by photographs which convey some idea of the roughness and channel conditions involved in the experiments. On the theory that these photographs will be useful to engineers generally who desire to apply the results of these experiments, it would seem that a much larger number of such photographs would have further increased the value of the data presented.

Abstracts and translations of original papers are included in the book, showing clearly the development of various slope formulas and the antecedents of such formulas, especially those of Ganguillet and Kutter, and Bazin. Many formulas less generally known are discussed, including the German and Austrian formulas of Siedek, Hessle, Christen, Hermanek, Biel, Matakiewitz and Lindboe. The author concludes—and without doubt correctly—that not one of these formulas is of much practical value. They are mostly based on considerations of an ideal channel, and like much German literature on kindred subjects in hydraulics and hydrology, they are stronger in the speculative than in the practical aspects of the subject. However, they are interesting if only as museum specimens, and may afford useful suggestions. Other recent formulas, including those of Schmeer and Barnes, are discussed but the general conclusion is reached that "although the Kutter formula is not ideal it is the best equation available at the present time."

Confirming its general use and utility, a brief list is given of some recent important hydraulic works on which the Ganguillet and Kuttler formula was used. In this list should have been included the New York State Barge Canal, probably the most important example of all in this respect, in that it involved over 400 miles of large natural and artificial channels, the hydraulic features of which were determined by the Ganguillet and Kutter formula. The substantial accuracy of these determinations has been verified by subsequent experience.

Criticisms frequently made of the Ganguillet and Kutter formula are cited. These are of two classes: (1) Criticisms, often sweeping, which are in effect only a confession of ignorance on the part of the critics; (2) specific criticism of the inclusion of a slope factor

in the formula, or of its accuracy when applied to very flat slopes. The slope factor was included in the original formula to adapt it to Humphreys and Abbott's gagings of the Mississippi River, and to answer this question recent gagings of the lower Mississippi are used. The evidence presented is not so convincing, one way or the other, that the reader may not interpret it differently from the author.

There is some discussion of Manning's formulas. The conclusion is reached that in most ordinary cases they give results practically identical with the Ganguillet and Kutter formula, with the same coefficient of roughness.

For very flat slopes and large channels, the author prefers the Ganguillet and Kutter formula with the slope correction factor (omitted from the Manning formulas). For such conditions the Manning and the Ganguillet and Kutter formulas do not agree with the same value of n and a question arises as to which is nearer the truth. The author states (p. 243): "The average error of the results calculated by the Manning formula for the gagings of Humphrey and Abbott was 19.8 per cent., while the average of those calculated by Kutter's formula was only 4 per cent." For very flat slopes the Ganguillet and Kutter formula gives the higher velocities. If, therefore, the reported velocities in the Humphreys and Abbott experiments are, say 8 per cent. too high, as elsewhere concluded, the showing would be changed to an error from the truth probably about equal for the two formulas.

King's "Handbook of Hydraulics" appeared about the time when Houk's book went to press, and is not cited by Houk. King's book contains a much more elaborate and thorough discussion of the relation of the Manning and the Ganguillet and Kutter formulas, and the conclusions of Houk on this subject should be read in conjunction with King's discussion.

It will probably appear to many that, except perhaps for very flat slopes on large streams, the Manning formula has the great advantage of simplicity, and yet one trained in the selection of values of n for one formula can in general apply these directly to the other, with assurance that in most cases the results will be nearly identical.

It seems also proper to add to the author's discussion that for very flat slopes, where the velocity in an appreciable portion of the cross-section is below the critical velocity, further exploration is needed. Here there is good physical reason for a slope correction, or else the use of a formula involving terms both for v and v', as in earlier formulas of Prony and Eytewein. The general comparison of slope formulas in Houk's book supplements and brings down to date a similar comparison contained in Humphreys and Abbott's classical monograph, in the added light of later experience. The book is a welcome and timely addition to the literature of hydraulics.

Shutting Water Out of Cased Wells

METHODS OF SHUTTING OFF WATER IN OIL AND GAS WELLS—By F. B. Tough. Washington, D. C.: Bureau of Mines. Paper; 6 x 9 in.; pp. 122; illustrated. 30c. from Superintendent of Documents.

Although written for oil and gas men, this excellent monograph contains much information equally useful for water-supply engineers and contractors. In oil- and gas-well practice it may be necessary to shut out water from either the bottom or the sides of the well. In water wells, the shutting out is usually from the sides, and reliance is often placed upon the casing—which may sooner or later prove inefficient—or it may be considered cheaper to use a thin casing, backed with cement grout. Most of this bulletin is devoted to the subject of stopping water inflow by cement, but attention is also given to the use of hydraulic lime and mud fluid. Equipment for cementing and also for mudding is described. There is also a section on calculating the thickness of casing needed for various depths.

A Current Compendium on Concrete

AMERICAN CONCRETE INSTITUTE: Proceedings of the Fourteenth Annual Convention, Atlantic City, N. J., June 25-26, 1918. Chicago, Ill.: The Institute. Cloth, 6 x 9 in.; pp. 581 illustrated.

Annual reports of societies, containing the papers presented at their meetings, are, as a rule, merely listed in this section, but the great specialization of the papers presented before the American Concrete Institute makes it worth while to give more than ordinary notice to the volume of "Proceedings" recently issued. While most of the papers are up to the usual average, there are three special features of the 1918 "Proceedings" to which concrete engineers should give great attention. The first is the paper by Prof. D. A. Abrams of the Structural Materials Laboratory, Chicago, entitled "Effect of Time of Mixing on the Strength and Wear of Concrete." The second is the report of the Committee on Concrete Roads and Pavements; and the third is the group of papers on concrete ships.

Professor Abrams' paper takes 70 pages of the "Proceedings." It is an exposition of an elaborate series of tests on various kinds of concrete, and embraces very much more than its title would indicate. For instance, the amount of water, the effect of consistency, the relative value of materials, grading, etc., all are discussed by the author. As it stands, it is the most complete résumé of concrete tests since that issued some years ago by the United States Bureau of Standards. The Committee on Roads and Pavements makes its report almost entirely of a 60-p. document entitled "Recommended Practice for Concrete Roads," by far the most recent and advanced statement of concrete-road technic that has yet been published. It contains drawings and photographs descriptive of recent concrete-road practice, as well as analyses of contractors' organizations and estimates of costs. The concrete-ship papers are noteworthy, and, with the present interest in that art, should receive considerable attention.

An Engineer in Action at the Front

FIGHTING THE BOCHE UNDERGROUND—By H. D. Trounce. Formerly of the Royal British Engineers; now Captain of Engineers, U. S. A. New York: Charles Scribner's Sons. Cloth; 5 x 8 in.; pp. 234; illustrated. $1.50.

Born in England and having spent most of his life there, the author went to Canada on coming of age, then attended the Colorado School of Mines, and in 1910 settled in California, where he practiced as a mining engineer and became an American citizen. In the latter part of 1915 he went to England, obtained a lieutenancy in the Royal Engineers, and for 18 months was at the front, engaged mostly in sapping and mining

operations. In the middle of 1917 he returned to California, and in October was commissioned as captain in the Engineer Officers' Reserve Corps. Meanwhile, at the solicitation of friends, this book was written.

The volume is a straightforward account of the author's experiences, largely in explosive mine tunnel work, at Vimy Ridge, on the Aisne, at Arras and on the Hindenburg line. Concluding chapters deal interestingly and informingly with "The Psychology of Fear" and "Some Principles of Mining," the latter being illustrated with sketches and a folding map. The volume has both general and technical interest.

Useful Notes on Rural Roads

THE LOCATION, CONSTRUCTION AND MAINTENANCE OF ROADS—By John M. Goodell. Reprinted from "Good Roads Year Book," 1917. New York: D. Van Nostrand Co. Cloth; 6 x 9 in.; pp. 207; illustrated. $1.

Discussion of rural road problems without the confusion inherent in a combined work on both urban and rural highway improvements is a feature of this work. In its preparation Mr. Goodell had the coöperation of over 50 leading highway engineers of America.

Location, general design and plans are first treated. Following this the various types of road ordinarily used in rural districts are taken up, separately, and are discussed as to the approved practice for specifications, construction and maintenance. Interspersed with these are special chapters on cement, petroleum and residuums, asphalt, tar and tar products, with specifications for each.

Following these constructional and maintenance features are general chapters covering highway bonds, the tractive resistance of various types of roads, and tables showing the mileage and improved condition of roads throughout the United States. The book closes with a chapter setting forth the general arguments to be used in promoting good-roads sentiment.

An Engineer's Forecast

THE ENGINEERING PROFESSION FIFTY YEARS HENCE—By Dr. J. A. L. Waddell, D. Sc., D. E., LL. D., Consulting Engineer; Reprinted from *The Scientific Monthly*, Vol. VI, No. 6, June, 1918, and Vol. VII, Nos. 1 and 2, July and August, 1918. Kansas City, Mo.: The Author. Paper; 7 x 10 in.; pp. 54.

First delivered before various engineering schools and societies, this lecture consists of a "Prelude"—treating of present conditions "affecting the welfare of the engineering profession, the long-continued attempt to establish an American Academy of Engineers, and what can best be done to take advantage of existing possibilities for the advancement of engineering in the United States"—and a "Retrospect." The latter is "intended to indicate what is practicable of accomplishment for the profession in the next half century, although it must be confessed that occasionally there is inserted in lighter vein a suggestion which might properly be termed imaginative."

The author's object in putting the lecture in print is to give engineers in general some topics to consider that are essentially different in type from those which they encounter in their daily routine of work—in the hope that, ultimately, at least a few of the innovations suggested may be materialized. The "Retrospect," which occupies most of the space, is supposed to have been delivered in 1968, by J. A. L. Waddell, 2nd. In the flights of his imagination the author sees many if not most of the pet projects of himself and his more intimate friends brought to a happy conclusion—thanks largely to the academies of engineers, economics and law and the Society for the Promotion of Engineering Education.

Studies for Railway Projects in India

RULES FOR THE PREPARATION OF RAILWAY PROJECTS, 1918: With Notes by G. Richards, M. Inst. C. E., Chief Engineer with the Railway Board, India. Simla, India: Railway Board. Paper; 8 x 13 in.; pp. 55; illustrated by typical plan and profile.

Instructions as to estimates of traffic earnings and operating expenses are a prominent feature of this book of rules, which is a revision of earlier editions.

General instructions are given in regard to preliminary survey or proper location, made by compass traverse; also for location survey by instruments. The instructions for fieldwork are based on the use of the 100-ft. chain. Compensation for grade is specified for both easy and sharp curves, the prescribed rate being 0.04% per degree of curvature on the 5½-ft. gage, 0.03% for meter gage, 0.02% for 30-in. gage and 0.015% for 24-in. gage, all these various widths of gage being included in the railway system of India. Transition curves are required and are to be spirals based on the cubic parabola. Other rules relate to the prescribed proceedings and forms for plans, profiles, estimates and reports; specimens of these are given.

Notes on Stadia Surveying

TOPOGRAPHIC STADIA SURVEYING: A Manual with Reduction Tables and a New Type of Reduction Diagram—By C. E. Grunsky, Eng. D., Mem. Am. Soc. C. E. New York: D. Van Nostrand Co. Flexible Cloth; 5 x 7 in.; pp. 95; illustrated (with pocket containing stadia reduction diagram.) $2.

The author of this little handbook, a well-known consulting engineer of San Francisco, presents these notes on stadia surveying, and a useful stadia reduction diagram which he has prepared as a result of many years' practical experience in such work. He plunges into technical definitions without any preliminary introduction, and describes the Porro telescope and other special terms. The theoretical formulas and descriptions of a satisfactory type of stadia rod are clearly presented, and are followed by a concise description of stadia surveying methods, with practical suggestions. In the chapter on the latter subject, he lists six departures from ordinary methods, relating to (1) the type of rod; (2) the elimination from the notes of the height of the telescope above a station plug; (3) the liberal use of the magnetic needle; (4) the method of keeping field notes; (5) the use of approximation formulas, and (6) the use of convenient stadia reduction diagrams.

The correction tables included and the satisfactory samples of notes should be helpful, also the hints on plotting stadia notes. C. G. Anderson's tables for reduction of stadia, used by the United States Geological Survey, are reproduced, and a complete explanation of the author's special stadia diagram is given.

British Engineering Standards

The British Engineering Standards Association (28 Victoria St., London, S.W., England), announces that as soon as necessary arrangements can be made its 87

publications, with a few exceptions, will be issued in French, Italian, Spanish and Russian, and that both these and the corresponding English texts will be sold at 1s. apiece, plus postage—generally 2d. The association was founded in 1901, as the Engineering Standards Committee, by five British technical societies—the Institutions of (1) Civil (2) Mechanical and (3) Electrical Engineers and (4) Naval Architects and (5) the Iron and Steel Institute. Among the subjects covered by the specifications thus far published are: Rolled structural sections; rails; portland cement; steel for bridges and buildings; cast-iron pipe, separately for (1) water, gas and sewage, (2) hydraulic power, (3) soil pipe, (4) waste and ventilating pipe; salt-glazed sewer pipe; tar, pitches, bitumens and asphalts for road purchases. A new report, just at hand, deals with fine screw-threads.

Progress Report on Run-Off

Pending the completion of its investigations and report, the Boston Society of Civil Engineers' Committee on Run-off has published a progress report consisting of a glossary of run-off terms, and five papers. The latter are as follows: "The 0.2 and 0.8 Method in Power Canals," and "Precipitation, Evaporation and Run-Off," by Arthur T. Safford, chairman of the committee; "Use of the Current Meter in Stream Gagings;" "Effect of Ice on River Discharge" and "Methods to Use in Compilation of Data," by C. H. Pierce, secretary. These papers, with a prefatory note by Mr. Safford, fill 35 pages of the *Journal* of the Boston Society of Civil Engineers for November, 1918 (Tremont Temple, Boston; 50c.).

Spanish-English Specifications

To facilitate foreign trade, the United States Bureau of Foreign and Domestic Commerce and the United States Bureau of Standards are coöperating in translating for circulation abroad "standards for materials of various kinds, commercially acceptable and representing good American practice." Thus far four specifications of the American Society for Testing Materials have been translated into Spanish and printed in that language and in English, on facing pages. The latest of these (Nos. 3 and 4), translated by Antonio Lano, cover (No. 3) open-hearth steel girder and high-tee rails and (No. 4) low-carbon steel splice bars (5c. each, from Superintendent of Documents, Washington, D. C.). No. 1 covered portland cement and No. 2 dealt with carbon-steel rails.

PUBLICATIONS RECEIVED

[So far as possible the name of each publisher of books or pamphlets listed in these columns is given in each entry. If the book or pamphlet is for sale and the price is known by the editor the price is stated in each entry. Where no price is given it does not necessarily follow that the book or pamphlet can be obtained without cost. Many, but not all, of the pamphlets, however, can be obtained without cost, at least by inclosing postage. Persons who are in doubt as to the means to be pursued to obtain copies of the publications listed in these columns should apply for information to the stated publisher, or in case of books or papers privately printed, then to the author or other persons indicated.]

BUILDINGS AND EQUIPMENT FOR SCHOOLS AND CLASSES IN TRADE AND INDUSTRIAL SUBJECTS: Trade and Industrial Series No. 4—Washington, D. C.: Federal Board for Vocational Education. Paper; 6 x 9 in.; pp. 72; illustrated.

BUREAU OF STANDARDS, ANNUAL REPORT OF THE DIRECTOR TO THE SECRETARY OF COMMERCE: June 30, 1918—Washington, D. C.: Bureau of Standards. Paper; 6 x 9 in.; pp. 206.

The number and variety of services rendered by the Bureau of Standards, as disclosed by this report, is far beyond what those not familiar with the work of the bureau would suppose. The pamphlet deserves wide circulation in order that the work of the bureau may be better known and a wider opportunity thus be given for utilizing its services.

COUNCIL OF NATIONAL DEFENSE: Second Annual Report, June 30, 1918—Washington, D. C.: The Council. Paper; 6 x 9 in.; pp. 275.

DIRECTOR OF THE BUREAU OF MINES: Annual Report to the Secretary of the Interior, June 30, 1918—Washington, D. C.: Bureau of Mines. Paper; 6 x 9 in.; pp. 118. 10c. from Superintendent of Documents.

FERRO-CONCRETE IN INDIA—By G. Richards, M. Inst. C. E., Chief Engineer with the Railway Board. Simla, India: The Author. Paper; 9 x 12 in.; pp. 85; illustrated.

The use of concrete is not confined to the United States and to Europe, as this document shows. For some time the Railway Board of India has been issuing technical papers through its chief engineer's office. A number of those relating to reinforced concrete have been gathered together and are now published under one cover. The pamphlet contains details of structures, paragraphs of specifications, results of tests, contract provisions, etc., all of which might be useful to American concrete engineers who wish to be fully informed on the progress of their art.

GRAPHICAL AND MECHANICAL COMPUTATION—By Joseph Lipka, Ph.D., Assistant Professor of Mathematics in the Massachusetts Institute of Technology. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 6 x 9 in.; pp. 264; illustrated. $4.

HIGHWAY MAINTENANCE: Devoted Especially to Patrol Maintenance on the State Trunk Highway System—Compiled by J. T. Donaghey, Maintenance Engineer. Madison, Wis.: Highway Commission. Paper; 6 x 9 in.; pp. 69; illustrated.

Contains instructions for those in charge of highway maintenance, including patrolmen, maintenance foremen, and county highway commissioners. Sets forth the proper methods to be used in each kind of work, the best time of year for each kind of road, the best weather conditions for each kind of work, and the kind of machinery to use and how to use it.

INTERNATIONAL HEALTH BOARD: Fourth Annual Report, Jan. 1, 1917-Dec. 31, 1917—New York: The Rockefeller Foundation. Paper; 6 x 9 in.; pp. 147; illustrated.

INVESTMENTS IN LATIN AMERICA AND THE BRITISH WEST INDIES—By Frederic M. Halsey, Special Agent, Washington, D. C.: Bureau of Foreign and Domestic Commerce. Paper; 6 x 9 in.; pp. 544; illustrated. 50c. from Superintendent of Documents.

JOHNSON'S MATERIALS OF CONSTRUCTION: Rewritten by M. O. Withey, Associate Professor of Mechanics in the University of Wisconsin, and James Aston, Metallurgist with the A. M. Byers Co. of Pittsburgh. Edited by F. E. Turneaure, Dean of the College of Engineering of the University of Wisconsin. Fifth Edition. New York.: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 6 x 9 in.; pp. 829; illustrated. $6.

OXWELDING AND CUTTING: Manual of Instruction—Newark, N. J.: Oxweld Acetylene Co. Paper; 5 x 8 in.; pp. 124; illustrated. 50c. Without Charge to Users of Oxweld Acetylene Apparatus.

REPORT OF THE COMMISSION APPOINTED TO DELIMIT THE BOUNDARY BETWEEN THE PROVINCES OF ALBERTA AND BRITISH COLUMBIA: Part I, 1913-16. Commissioners, R. W. Cautley, D.L.S., A.L.S., J. N. Wallace, D.L.S., A. O. Wheeler, B.C.L.S. Ottawa, Can.: Office of the Surveyor General. Cloth; 7 x 10 in.; pp. 189; illustrated. Atlas; 19 x 15 in. pp. 27.

RETAINING WALLS: Based Entirely on the Theory of Friction—By Pedro J. Dozal, C. E., Escuela Nacional de Ingenieros de Mexico. Done into English by R. T. Mulleady, B.Sc. Eng. (Birmingham.) Buenos Aires: The Author. Cloth; 7 x 10 in.; pp. 155; illustrated.

SOME COMPRESSION TESTS OF PORTLAND CEMENT MORTARS AND CONCRETE CONTAINING VARIOUS PERCENTAGES OF SILT—By Arthur C. Alvarez and James R. Shields. Berkeley, Cal.: University of California. Paper; 7 x 11 in.; pp. 13; illustrated.

STORING: Its Economic Aspects and Proper Methods—By H. B. Twyford, Otis Elevator Co., Author of "Purchasing: Its Economic Aspects and Proper Methods." New York: D. Van Nostrand Co. Cloth; 6 x 9 in.; pp. 196; illustrated. $3.50.

SURFACE WATER SUPPLY OF THE UNITED STATES—Nathan C. Grover, Chief Hydraulic Engineer. Washington, D. C.: U. S. Geological Survey. Paper; 6 x 9 in.; illustrated. No. 432: 1916. Part II. South Atlantic and Eastern Gulf of Mexico Basins; Guy C. Stevens and Warren E. Hall, District Engineers. Pp. 53. No. 435: 1916. Part V. Hudson Bay and Upper Mississippi River Basins; W. G. Hoyt and A. H. Horton, District Engineers. Prepared in coöperation with the States of Minnesota, Wisconsin, Iowa and Illinois. Pp. 204. No. 441: Part XI. Facific Slope Basins in California, H. D. McGlashan and F. F. Henshaw, District Engineers. Prepared in coöperation with the State of California. Pp. 330. No. 465: Hawaii, July 1, 1916, to June 30, 1917; G. K. Larrison, District Engineer. Prepared in coöperation with the Territory of Hawaii. Pp. 184. No. 428: Artesian Waters in the Vicinity of the Black Hills, South Dakota; by N. H. Darton. Pp. 62.

THE UNITED STATES GEOLOGICAL SURVEY: Report of the Director to the Secretary of the Interior, June 30, 1918—Washington, D. C.: U. S. Geological Survey. Paper; 6 x 9 in.; pp. 154; illustrated.

SOCIETY SERVICE

A Section Dealing with the Results of Teamwork by Technical Men

"Service Bureau" Established by San Francisco Societies

In San Francisco there has recently been established an "Engineers' Service Bureau" which is intended to serve as a clearing house through which engineers in search of employment may get in touch with prospective employers and through which employers may find technical men promptly, as they are needed. This bureau is being conducted at the San Francisco Engineers' Club through the Joint Council of the San Francisco engineering societies. In this organization are represented the local sections of the American Society of Civil Engineers, the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, the American Society of Mining Engineers and the American Chemical Society.

The bureau is to be provided with as complete a list of engineering vacancies as it is possible to compile, and endeavor will be made to keep this list up to date. Applicants are to state their qualifications and experience on blank forms which are to be sent in by mail. As these applications come in they will be compared with the "Engineers Wanted" list. If a call is found for a man with the qualifications given, the applicant will be notified at once. Otherwise, his application will be filed without acknowledgment, awaiting a call. The bureau is to give information only by mail or telephone; no applicants are to be received in person.

Notice of the establishment of the bureau has been sent to more than a thousand engineers on the mailing lists of the several local sections, and every effort is being made to encourage the support of the individual members. It is felt that if the general coöperation of the members is secured in the matter of reporting vacancies, the bureau will be able to handle applicants effectively, and the plan can be made permanent. Positions to be included within the field of the bureau's activities are such as "could be filled by civil, mechanical, electrical, mining or chemical engineers, inspectors, construction superintendents, assayers, surveyors, draftsmen, or, in general, men with technical training and experience in the fields of the five societies represented."

Minnesota's Inclusive State Society Nearing Organization

Following the Engineering Council's suggestions—for greater coöperative activity—as sent out to the various engineering societies and brought to many organizations in person by the secretary, A. D. Flinn, the Engineers' Society of St. Paul, Minn., has had a special organization committee working on a plan for a state society. It wanted one that could function more surely and serve the engineers and engineering societies in a better way than has the Minnesota Joint Engineering Board, if possible, although that body has probably done more effective work than any similar organization in the country. Note was made of the original move in this column, Dec. 19, 1918, p. 1141, but a later *Bulletin* of the affiliated Engineering Societies of Minnesota indicates changes from the original tentative proposal.

It is felt that the name Minnesota State Polytechnic is not so good as Minnesota United Engineering Society, for the word "Engineering" should not be omitted. Eight sections are proposed: Electrical, mechanical, mining, structural, highway, drainage, municipal and railroads. Each member shall be enrolled in one or more sections, but vote in but one. Societies would become associated with the state organization, and the members would become, automatically, members of the larger body. In addition, any engineer with the necessary qualifications residing or practicing in the state may become a member. A somewhat complicated system of government of the affairs of the society is proposed, but with the idea of representation according to the different branches of engineering, and not in any respect according to local societies.

An annual convention is to be held at which any one or more sections may have separate meetings for technical papers and transact business pertaining to the section.

A business meeting of elected delegates is to take place, and a general program is to be provided by the board. Delegates are to be elected as follows: Each section shall elect a member of the Minnesota United Engineering Board, which member shall be one of the delegates of that section at the annual business meeting. Each section shall also elect one delegate-at-large to the annual meeting.

Each associated society shall elect one delegate-at-large to the annual business meeting for each 50 of its membership, provided it shall be entitled to one delegate if it have but 30 members.

The officers of the Minnesota United Engineering Board shall be the corresponding officers of the Minnesota United Engineering Society, and with the other members of the Minnesota United Engineering Board shall constitute the board of directors of the Minnesota United Engineering Society.

LETTERS TO THE EDITOR

Comment on Matters of Interest to Engineers and Contractors Will Be Welcome

Drainage of Irrigated Land

Sir—In connection with the article on the Imperial Valley seepage case, on p. 237 of the issue of Aug. 1, 1918, and your editorial on the same subject in the issue of Aug. 8, I desire to call attention to another phase of the problem.

It is a well known fact that, in time, portions of nearly all irrigated lands will become water-logged and alkalied to such an extent as to preclude the possibility of profitable farming on the affected areas. It is

conceded that, in general, this water-logging is due to the rise of the ground water. All waters going into the ground beyond those used by plants or evaporated from the soil tend to raise the ground-water level in the low places. These waters may include seepage losses from reservoirs, transmission losses in main canals, laterals and farmers' ditches, deep percolation losses from irrigated fields and waste water allowed to run into sink holes and low places, from which it slowly seeps away into the ground water. As a rule, deep percolation losses from irrigated fields constitute the largest factor in water-logging soils.

Thus it is evident that, in a majority of cases, it is impossible to ascribe the damage to any particular one of these parts of the irrigation system. As a matter of fact, all, or nearly all, of these sources are usually present, and it can be said truthfully that the damage is done by the whole irrigation community, including those using reservoirs, canals, laterals, higher lands and lower lands alike.

When any considerable area of land in a district has become water-logged, two courses are open to the owners. They may abandon them either partly (by devoting them to pasture) or wholly, or they may drain them. In each case these owners may shoulder the whole burden or it may be distributed. In the first case they may suffer the loss with as good grace as possible, or they may attempt to reimburse themselves for their loss by suing the owners of higher lands or canals, as in the Imperial Valley case. This is always expensive and the results are doubtful, to say the least.

In the second case the drainage may be done by the owners of wet lands, either singly or through some organization which includes only owners of wet lands, or it may be accomplished by the organization of a drainage district taking in not only the wet lands but the higher contributing lands, including the canals.

Several of the Western states have made provision through the enactment of suitable drainage district laws for the formation and administration of such districts. The Idaho law provides that higher lands and canals may be assessed for part of the cost of constructing drainage systems in proportion to their responsibility for the damage. This provision has been upheld by the state supreme court, both as to higher irrigated lands and as to canals. (Burt vs. Farmers' Coöperative Irrigation Co., 30 Idaho, 752). There are similar provisions in the laws of Montana, Oregon and Washington.

The tendency in Idaho is toward assessing the costs, in districts where all the wet lands have become so as a result of irrigation, at a flat rate per acre over the whole district. Such a flat rate for drainage costs in an irrigation district was recently upheld by Judge Isaac F. Smith in the seventh judicial district of Idaho.

The method of solving the seepage problem by draining the wet land and apportioning the cost over all the lands contributing to its water-logged condition has a number of advantages. It restores the land to a condition permitting a high state of cultivation, instead of allowing it to become mosquito-breeding marsh or an alkali-covered waste. It prevents the loss of home and improvements by the unfortunate owner of lower-lying lands. It divides the cost of reclamation among all those who have contributed to the damage, instead of making the owner of the low land pay the total cost of reclamation in addition to the loss of the use of the land during the interval, often long, between the time when the land becomes water-logged or alkalied and the time when it is reclaimed by drainage.

With the provision that such districts must not be constructed unless the enhanced value which will accrue to the lands of the district will exceed the cost of drainage, including organization and construction, there seems to be no danger that this solution of the problem will retard or cripple the irrigation development of the West. In fact, it should help that development, as it provides a feasible and equitable way of restoring the fertility of water-logged lands.

M. R. LEWIS,
Irrigation Engineer.

Boise, Idaho.

Problems Before American Society of Civil Engineers

Sir—Referring to the discussion of the problems before national engineering societies: I am summing up here the recent arguments I have heard. There is some uncertainty as to whether or not the governments of the national engineering societies are now supported by majorities such as are generally presumed to determine policies and carry them into effect. It has yet to be proved that any society can live indefinitely when its nourishment is limited to things technical.

By "society" we may mean (1) the collective body of persons forming a community, or the aggregate of such communities; (2) any body of persons connected by acquaintance, friendship or neighborhood, or associated for a common object; (3) the more favored class or classes or the fashionable portion of a community; the term "society" is then often used attributively; and (4) association in social relationship, fellowship, or companionship.

Our national engineering societies were doubtless organized under the theory set forth in definition 2—that is, "persons associated for a common object." The pioneer members of the society felt the need for an organization which would permit them to exchange ideas relating to engineering theory, design and construction. In their time, scientific research and investigation were sorely needed. The necessity for great activity in this kind of work on the part of the society has decreased as other agencies, better organized and better qualified to assume leadership, have come into being. The "common object" has remained practically unchanged, regardless of altered conditions.

The society has become more institutionalized, while its management is said to be less democratic, than during the earlier years of its history. The engineer has not given much study to the meaning of the words "civil engineer." The engineer who has tried to frame a registration law for civil engineers appreciates how difficult it is to define these words clearly. Yet we have all the machinery that any organization has evolved for its business management. That we lack something that pervades the atmosphere of the American Medical Association, and even of the American Bar Association, is clear to the engineer who has studied the activities of those two societies.

The technical field of the civil engineer is so broad that it is difficult to arouse a general interest among the members of the society in the study or discussion of a paper of great merit, as it generally concerns an isolated branch of theory or practice. Able critics hold that the society has already lost its place as a leader in the technical field, and that it has fallen under the influence of an element that may be indexed under the third definition of "society." If a change has taken place, let it be hoped that it is of a kind to encourage evolution in the right direction. If the change tends toward a condition that may be described under definition 4, we have cause for a feeling of optimism.

The engineer is too ready to provide machinery and to set it going, and then to leave it, assuming that the plant will produce desired results. His societies are inclined to be technical and impersonal. He is, speaking generally, an individualist of a somewhat extreme type. He is seldom the first to suggest coöperation. His time is largely occupied by investigations of a technical nature. His study and his leisure reading are not likely to direct his attention to "society" in its broad sense. While he is presumed to live in an atmosphere that is saturated with the sentiment of democracy, his organizations have been inclined to become more autocratic in government.

Recently the officers of the national engineering societies—some twenty to thirty men—committed the entire membership of thirty thousand in support of legislation before Congress, without giving the rank and file an opportunity to express individual views. This does not smack of democracy. The engineer is to achieve greatness through service. Opportunities for maximum service may be somewhat clouded when the element that largely dominates the policies of organizations (presumed to be representative) centers at the financial and industrial metropolis of the country. If these governmental defects are common to the four Founder societies, each should clean house before the average member will take much interest in any plan which contemplates their amalgamation.

The growth of local chapters, or associations, of the American Society of Civil Engineers suggests a longing for personal contact among its members. While some of these local associations will doubtless indulge in technical discussion for a time, in imitation of the parent body, the members will ultimately discover, I believe, that another cause leads them to assemble at a local headquarters where men of common interests may become mutually helpful through social intercourse. If these local associations do not recognize the motive which prompts their organization, I predict that they will be short-lived.

It is evident that the local associations are ultimately to dictate the policies of the national society. All centers of population will provide opportunity for such associations, and when the number multiplies to the point where a majority of the members are identified with one of the smaller organizations, the parent society must step aside and submit to the commands of these groups. The business of the national society will then be transacted through representatives of the local associations—and New York, instead of being the national headquarters, will simply support a local association of its own and will cease to use the facilities of the society for the benefit of a local club, as it is now presumed to do by many who simply stand and wait.

An organization which manifests but little interest in human problems is not likely to enjoy the permanent, sympathetic support of its members. The civil engineer may argue that he performs his greatest service to society when he perfects the technical machinery of his own profession. This kind of argument appeals to the man who is content to be recorded as a technician, pure and simple. Such a man manifests no sympathy for his associates in the engineering field; he has no concern regarding the welfare of his neighbors; public interests never disturb him, and the word "altruism" is not to be found in his dictionary. A society made up of men of this type must be a drab affair. That such a society must slowly disintegrate as its members begin to obtain a vision of opportunity for higher service is apparent.

The prominent engineer of the near future must exhibit as much interest in the welfare of his associates as in his own business or technical success. Engineering will have a place among the real professions when engineers accept these broader responsibilities.

CLARENCE T. JOHNSTON,
Professor of Surveying, University of Michigan.
Ann Arbor, Mich.

Are Bridge Engineers Losing Their Heads On Unit Stresses?

Sir—The report of the Committee on Column Tests of the American Society of Civil Engineers appears to have caused some fright among bridge designers; for I notice that the Engineering Institute of Canada has lately published a "General Specification for Steel Railway Bridges" in which the unit stress for columns is given by the formula,

$$p = 12{,}000 - 0.3(l/r)^2$$

in which l = the unsupported length of the column in inches and r = its least radius of gyration in inches.

This is quite a sudden jump from the old standard formula,

$$p = 16{,}000 - 60l/r$$

The change indicates one of two things: Either that hitherto we have been overstressing compression members from 15 to 25%, or that there is going to be wasted a vast quantity of metal in the future.

Moreover, in making such a sweeping change in the compression formula the writers of the Canadian specifications were not consistent, because in Clause 47 they allow for the compression flanges of beams an intensity of

$$16{,}000 - 200l/b$$

In the case of railway stringers l/b is generally in the neighborhood of 10; hence the intensity of working stress is about 14,000 lb. As b is equal to about $4.5r$, for $l/b = 10$ we shall have $l/r = 45$. Substituting this in the Canadian column formula gives

$$p = 12{,}000 - 0.3(45)^2 = 11{,}400 \text{ lb.}$$

In the case of one compression member of a bridge, it appears to be legitimate to stress the metal up to 14,000 lb. per square inch, and in another up to only 11,400 lb. per square inch, a difference of 23 per cent. And

there is no valid reason for stressing differently a strut which forms a part of the top chord of a truss and a strut which forms a part of the top flange of a beam. "Consistency, thou art a jewel!"

If the correctness of the formula for compression flanges of beams be conceded—a formula which, for a dozen years or more, has been one of the clauses of the American Railway Engineering Association's standard bridge-specifications, and which the Engineering Istitute of Canada has appropriated without change—and if it be granted that b is generally equal to about $4.5r$ —why should not the equivalent formula,

$$p = 16{,}000 - 44l/r,$$

apply in general to struts with fixed ends? Be it noticed that this formula gives higher results than does my old formula,

$$p = 16{,}000 - 60l/r.$$

The American Railway Engineering Association is getting ready to trim down materially its old intensities for steel struts, although not to the extent that the Engineering Institute of Canada has done.

What aggravates the effect of this proposed decrease of compression intensities is that, simultaneously therewith, the American Railway Engineering Association is contemplating increasing its tensile intensity of working stress from 16,000 lb. to 18,000 lb.; and other specification writers are advising that it be made as high as 20,000 lb. To an outsider it must look as if the bridge engineers of this country were losing their heads!

The compression tests that started the present wave of apprehension did not have governing conditions corresponding properly to those of actual truss-members; hence I would suggest that, before the bridge engineers of America take the drastic step of assuming steel in compression to be only 60 or 70% as strong as the same material in tension, some really practical tests of struts be made under conditions corresponding to those in actual structures. Such a series of tests would cost considerable money; but, if the Bureau of Standards at Washington were to indorse the suggestion to make them, it ought not to be at all difficult to obtain from Congress an ample appropriation for the purpose.

The method of conducting these tests that I have in mind is this:

Let there be built a five-panel riveted-truss bridge of about 100 ft. span; let the middle panel-lengths of the top chords thereof be made decidedly weaker than all the other portions of the structure; and let a uniformly distributed live load be applied at the panel-points by hydraulic pistons. All portions of the structure, including the two weak members, should be scientifically detailed, so that failure will inevitably take place in the main portions of the weak struts and not in the details thereof, and so that the bridge can be used for a long series of tests to destruction of the said mid-panel lengths of the top chords. The weak members should be attached to the connecting plates with an ample number of rivets to develop the full strength of the test pieces; and these rivets should be removed carefully after each test to destruction is completed.

Of course, it would be entirely practicable to vary the value of l/r in the different tests, provided that the attachment of the test-strut be not made eccentric.

There should be a supporting platform beneath the span to prevent its falling any material distance when failure occurs.

By adopting a weak vertical post instead of a weak panel-length of top chord, and by loading (at the elevation of the latter) three panel-points only, a series of tests could be made on vertical posts. A similar series could be carried out on the inclined end posts.

A cheaper method than that just described, but not quite as satisfactory, would be to build a single truss, instead of the complete span, and steady it laterally but not vertically, and then to apply the test loadings directly above the top chord at the panel-points. A great advantage of the span tests as compared with the truss tests is that duplicate tests could be made simultaneously on similar members. Moreover, the span tests would be in practically exact accord with actual conditions of loading, while the truss tests would not.

By removing occasionally the test loading, the elastic limits of the struts could be ascertained through noting the absence or otherwise of permanent set.

Experiments similar to those described could be made on a pin-connected span or a pin-connected truss so as to determine the strength of struts with hinged ends.

In view of the immense amount of bridge manufacture and construction that is likely to be done in the United States within the next five or ten years, the making of this proposed series of tests is worthy of being considered a matter of national importance.

J. A. L. WADDELL,
Consulting Engineer.

Kansas City, Mo.

International Language for Modern Engineers

Sir—Some years ago, during a voyage across the Pacific Ocean, I became acquainted with an English naturalist who jokingly defined the American engineer as a "most migratory species of mammalia." No wonder that among the engineers one may find many who know or study foreign languages—Spanish, German, French, even Chinese or Japanese—and not a few who can read, write and speak in Esperanto.

I never will forget my surprise when, in 1915, during the world exposition at San Francisco, I approached a group of gentlemen talking Esperanto, and found that more than half of them were engineers; as far as I recollect, among that group were H. Babcock, of the Southern Pacific Co.; F. G. Cottrell, mining engineer now at Washington, D. C., occupying an important post in the Bureau of Mines; a civil engineer with a difficult Slavonic name, and Professor Languel, mechanical engineer and professor of mechanics at the University of California.

No doubt readers of *Engineering News-Record* use or know this international language and might be interested in the only technical journal published in Esperanto, edited by Dr. R. Saussure, grandson of the renowned scientist H. Saussure who made the famous exploration of Mont Blanc in 1787. The name of this monthly is *La Teknika Revuo* (10 Hotel Glasse, Berne, Switzerland; annual subscription 5 francs, less than a dollar). The first number was published in July, 1918. The reading matter is subdivided into the following sections: Editorial; science; industry and commerce;

international associations, and technical dictionaries. It also includes a list of the 20 periodicals published at present in Esperanto in different countries. Among them we find Amerika Esperanto, West Lynn, Boston, Mass.

Knowing from my own experience how Esperanto is useful during travel and for obtaining first-hand technical information in foreign lands, I sincerely believe that any engineer who is too busy to learn several foreign languages will be benefited immensely by familiarizing himself with Esperanto, which he can acquire in his spare minutes of relaxation from routine professional work. At the same time Esperanto will enable him to come in contact with any foreign country, through the agencies or Esperanto delegates whose names are printed regularly in the Esperanto Year Book. Further information may be obtained from the Esperanto Association of North America, West Newton, Mass.

CIVIL ENGINEER.

Washington, D. C.

Spacing of Rivets in Lateral Bracing

Sir—The accompanying tables show the spacing of rivet holes for lateral bracing angles, giving a clearance of ½ in. between angles or between angles and chord.

These tables, while very simple, are not found in handbooks, and greatly facilitate the design of lateral systems.

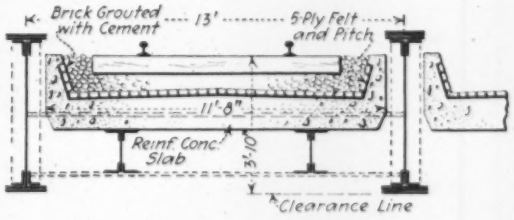
Thinking they may be of interest to designers, I have taken the liberty to forward them for publication, knowing that thus they would obtain wide circulation.

Dayton, Ohio. EDMUND FELDMAN.

Concrete Trough-Slab Floor Construction for Railway Bridges

Sir—In the discussion of waterproofed railroad bridge floors by H. T. Welty, in your issue of Dec. 12, p. 1081, a type worthy of note is not mentioned. This is the construction, shown by the accompanying sketch, in which the track is carried in a reinforced-concrete trough which is separate from the girder. The trough is supported by longitudinal beams under the rails. The vertical distance required from underneath the clearance line of the girder to the base of the rail is 3 ft. 10 in., or about the same as is required for the more recent designs of those described by Mr. Welty.

My observation has been that where concrete floors are finished against the girder the most careful application of waterproofing material and the most careful attention to details will not insure complete success. In a series of bridges, some will be altogether tight, and others will show a slight discoloration on the under side, usually at columns. These defects do not pass water through in any appreciable amount, and are of no disadvantage from the point of view of the users of the street under the bridge. But they are serious in that a slight percolation of water to the fabric of the bridge endangers the structure, and means that the chief function of the waterproofing, to protect the steel, has not been accomplished. An unpleasant feature of this situation is that no information can be had as to whether the bridge is safe or unsafe, covered as it is by concrete.

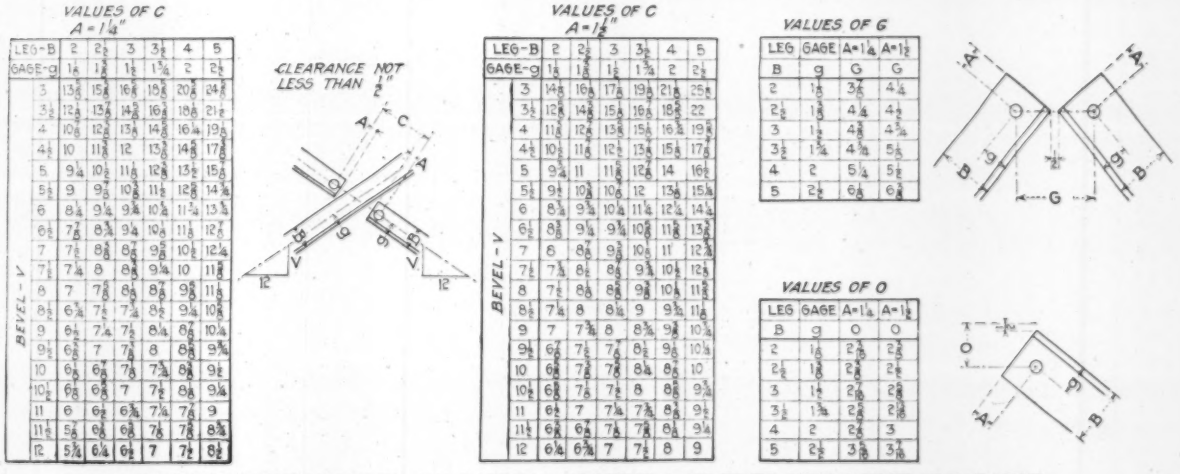


REINFORCED-CONCRETE BRIDGE TROUGH NOT FINISHED AGAINST THE GIRDERS

In the design shown by the sketch the bridge members are all exposed and are protected by paint. There is no difficulty about the waterproofing. In fact, the brick and felt protection shown could in many cases be omitted.

JERVIS VAIL,
Assistant Engineer, Pennsylvania Railroad.

Rahway, N. J.



SPACING OF RIVET HOLES FOR LATERAL BRACING ANGLES TO GIVE ½-INCH CLEARANCE

Heavy Road Traffic in Colorado

By a census taken under the auspices of the Colorado State Highway Department, the Santa Fé Trail is shown to have carried a traffic of 24,900,000 ton-miles. The next heaviest section in the state, the roads between Pueblo and Colorado Springs, carried 17,300,000 ton-miles.

HINTS FOR THE CONTRACTOR

DETAILS WHICH SAVE TIME AND LABOR ON CONSTRUCTION WORK

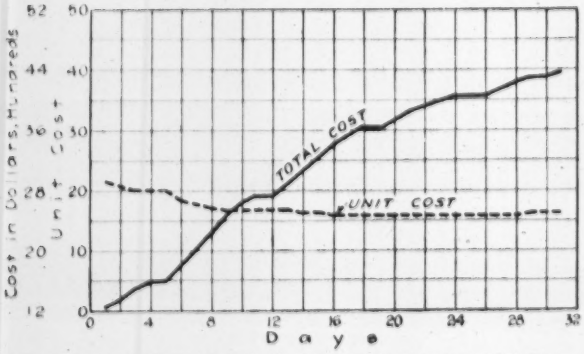
Only Completed Work Counts in Monthly Estimates

THE mixer was operating at possibly quarter capacity on a certain construction job. Only a part of the regular crew had reported for work that day. Such occurrences were not unusual last summer, when war industries were clamoring for workmen, and contractors had to be prepared to make the best of them. In this particular instance the contractor could have shut down the mixer and sent the men home. He could, if there had been opportunity, have transferred the men to other gangs. He could have put the men at work trimming stock piles or cleaning around the mixer, or otherwise marking time.

He did none of these things. Instead, he put the men at work operating the mixer and placing concrete at such speed as they were able. Obviously, the plant was not working economically. The contractor knew this. But he pointed out that, on the other hand, work which was being done was work which would count as money when the monthly estimate was made up. The incident is not very important in itself, but it exemplifies an important truth: Volume of construction completed is the only thing that counts in the contractor's monthly estimate. C. S. H.

Simple Chart Provides Complete Labor Cost Analysis

TWO curves record labor costs for construction performed by the Detroit Edison Co., as shown by the sample chart reproduced herewith. By a series of simple computations, using data read from the curves, a dozen facts of direct utility in checking construction costs and in estimating the cost of prospective work



LABOR COSTS FOR CONSTRUCTION SHOWN BY CHART

may be deduced. In fact, states William M. Ferguson of the Detroit Edison Co., in the *Synchroscope*, the curves furnish on a few sheets facts which reflect conditions of the work which would not be noticed in a lengthy report nor be seen by looking the work over in the field.

From the total cost curve can be read directly the total cost of the job at any time during the progress of the work. The second curve shows at any date the cost per unit of material placed—as, for example, the cost per cubic yard of concrete or per thousand of brick. It is obtained by dividing the total cost to date by the volume of material placed to date. The values for platting both curves are obtained from the time tickets each day, the backs of these tickets being used for reporting the amount of material used during the day's work.

Besides giving the total and unit costs at any date by direct reading, computation determines: (1) Total quantity of material, by dividing the total cost at any date by the unit cost as of the same date; (2) the cost for any day or the quantity of material placed for any day, by subtracting the total to date on the day previous from the total to date on that day; (3) the days of lost time, by counting the number of days that the total cost line extends horizontally; (4) the percentage, complete to date, by dividing the total quantity by the total estimated quantity multiplied by 100; (5) the percentage of work done from one date to another, by subtracting the totals at the two dates, dividing the remainder by the total for the whole job, and multiplying by 100; (6) the percentage of appropriation used, by dividing the total cost to date by the total estimated labor cost, and multiplying by 100. The unit time, or man-hours per unit of material placed, is another unit which may be obtained by dividing the unit cost by the rate per man per hour.

On the Detroit Edison Co. work the charts are kept by jobs, which are subdivisions of construction work orders; that is, each work order is divided into jobs according to the kind of material to be placed or the kind of work to be done.

Place Gravel Well Strainers in Shell

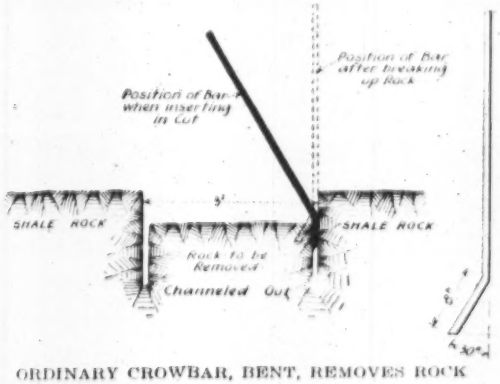
WATER for Camp Dodge, near Des Moines, Iowa, came largely from a 50-ft. circular open well 31 ft. deep, with the shell built of concrete, in which 30 strainers were inserted to permit water to enter from the sides as well as from the bottom. L. P. Wolff, in describing the engineering features of the camp in the *Bulletin* of the Affiliated Engineering Societies of Minnesota, states that the open well was constructed by building up the walls in sections above the water line, and then sinking them by excavating from the inside with a clamshell bucket operated by a derrick and hoisting engine. The bottom of the well was left about 5 ft. above the level of the blue clay. The strainers consist of openings in the wall filled with graded, screened gravel held in place with perforated cast-iron plates. Before being sunk, the screens were covered on the

outside with $\frac{3}{16}$-in. steel plates to prevent the entrance of the fine top soil, a cable being attached to each plate for the purpose of withdrawing it after the excavation was completed.

Bent Crowbar Easily Removes Shale Rock

By G. W. McAlpin
Point Pleasant, W. Va.

AN ORDINARY crowbar, bent back at the bottom for about 7 or 8 in. of its length to an angle of about 30 deg., proved a very useful tool in removing shale rock from a channeled key. As the key was narrow


Position of Bar when inserting in Cut
Position of Bar after breaking up Rock
SHALE ROCK
SHALE ROCK
Rock to be Removed
Channeled Out

ORDINARY CROWBAR, BENT, REMOVES ROCK

the rock was removed by hand, in preference to shooting. The bar was inserted in the channel cut and then pulled back. Thus the shale was torn up and its removal with shovels made possible.

Weed- and Root-Grubbing Implement Useful on Highway Maintenance

By E. Earl Glass
Monrovia, Cal.

A HOME-MADE combination hoe and hook has been used with excellent results in Los Angeles County, California, in clearing the weeds, sod and roots from the shoulders of the county highways. Combining two of the tools ordinarily used for this work, it not only reduces the number of pieces to be carted about the job but also saves considerable time which formerly had been consumed in changing from one tool to the other.

To make the implement, get a 16-in. piece of $\frac{3}{4}$ x $\frac{1}{4}$-in. steel and sharpen it at both ends. Then heat the steel to redness, bend it around the eye of a stout hoe and rivet it securely, as indicated in the illustration, which shows the tool in use on highway maintenance.

In operation, the tines formed by the bent steel serve to loosen gravelly soil, and are useful in removing tough weeds and roots and in hooking the loosened sod from the shoulders. A mattock, similarly fitted, has proved valuable for heavier work.

COMBINATION TOOL LOOSENS ROOTS, WEEDS AND SOD ON HIGHWAY SHOULDERS

Home-Made Truck Supports Welding Outfit

By E. Earl Glass
Monrovia, California

TO FACILITATE the handling of a welding outfit, the small truck to support the apparatus, as shown in the illustration, was constructed from scrap by the shop men of the Los Angeles County Road Department. This addition to the welding outfit makes one-man operation and conveyance possible.

To make the truck, parts were secured from several machines. The frame was obtained from an old steel bicycle rack, the wheels came from a discarded lawnmower and these were combined with the base and pipe handle to make a well-braced truck which proved very handy and useful as a support for the gas tanks.

WELDING OUTFIT ON HOME-MADE TRUCK

Submerged Dividers Used on Concrete Walks

Submerged steel division plates were used on one-course concrete sidewalks constructed by the roller method at Donora, Penn. This method was described by W. M. Kinney, of the Universal Portland Cement Co., in *Engineering News-Record*, of June 20, p. 1196. The work was being done for the American Steel & Wire Co. on an extensive concrete housing development, requiring 25,000 sq.ft. of 5-ft. walk. The steel plates were $\frac{3}{16}$ in. thick, 5 ft. long and of a depth that would not project above the finished surface when in position. Where wooden forms were used, the plates were held in position by steel pins; where steel forms were used the plates had a special hook at the end which fitted into a prepared slot in the form. The concrete was filled to a depth of $\frac{1}{2}$ in. above the top of the plates and thoroughly rolled longitudinally, with the concrete roller. When it had stiffened sufficiently, the plates were removed by means of hooks, and the surface over the division line was grooved in the usual manner. A $\frac{1}{2}$-in. prepared bituminous expansion joint was placed every 50 feet.

NEWS OF THE WEEK

New York, January 16, 1919

F. S. Curtis, President of American Society

Engineer and Railroad President Elected at Annual Meeting In New York

Fayette Samuel Curtis, president of the Old Colony R.R., and previously vice president and chief engineer of the New York, New Haven & Hartford R.R., was elected president of the American Society of Civil Engineers at the annual meeting in New York this week. His experience in civil engineering in a period of over 40 years has been almost entirely in railroad work.

Mr. Curtis was born Dec. 16, 1843, at Owego, N. Y., and received his early education at the public and private schools of Owego, after which he took a course in civil engineering at Owego Academy. He began his engineering work in the summer of 1863, when he was employed by the Albany & Susquehanna R.R. Co. in the location and construction of a line between Binghamton and Albany. In 1866 he was engaged by the Southern Central R.R. Co. in railroad location and construction between Oswego and Auburn, and in 1869 rendered similar service for the Lake Ontario Shore R.R. between Oswego and Rochester. In 1870 he entered the service of the New York & Harlem R.R. as assistant engineer, and was engaged in surveys for the towns of Tremont and Fordham, now included in New York City. In 1871 he represented the Harlem River & Portchester R.R. Co. in the location of lines between New Rochelle and the Harlem River, and in the fall of 1871 was employed by the New York & Harlem R.R. Co. in the location of tracks and yards at the Grand Central Station, after which he was principal assistant engineer in the preparation of plans for and later in the construction of the Fourth Ave. improvement between the Grand Central Station and the Harlem River.

A few years later he was appointed chief engineer of the New York & Harlem River R.R. and superintending engineer of the Fourth Ave. improvement, continuing in the service of the New York & Harlem and New York Central & Hudson River R.Rs. until 1883, when he was appointed chief engineer of the New York, New Haven & Hartford R.R. He served as chief engineer of the New Haven until March, 1910, when he was elected fourth vice-president of the company, in general charge of the engineering department and other matters, with headquarters in Boston. Three years later he was promoted to the second vice presidency, but, owing to the large amount of en-

(*Concluded on page 162*)

American Society Passes Resolution Favoring Development of Public Works

Annual Meeting Also Indorses Action of Protest Against Dismissal of Engineers of Public Service Commission in New York

Disappointing in the fact that no discussion whatever was started on the report of the Development Committee, the annual meeting of the American Society of Civil Engineers Jan. 15 nevertheless passed two significant resolutions—one on the action of the Engineering Council in calling a hearing of protest in regard to the dismissal of engineers of the Public Service Commission of New York, and the other a strong resolution favoring the active and immediate prosecution of public works for the purpose of furnishing employment, especially to returning soldiers. The work of the National Service Committee in Washington was outlined and members were requested to offer suggestions.

New President of American Society of Civil Engineers

FAYETTE SAMUEL CURTIS

As was the case last year, the annual address by the president was read at this meeting, the summer convention having been omitted on account of war conditions. Pres. A. N. Talbot reviewed the activities of the society for the past year, and called attention to the vital part played by engineers in the war. A total of 1593 members, ranging from major generals and rear admirals down through the ranks, had entered the service. In addition, large numbers of members sacrificed financial and home interests to give their time to Governmental and war activities. In addition to reviewing the details, which will be found in the report of the Board of Direction, noted below, President Talbot stated that the John Fritz medal, awarded to J. Waldo Smith for his services in engineering and his achievement in providing New York with a supply of water, was the second award to a civil engineer, of the total number of 14 awards of this medal made up to this time. He mentioned the work of the American Engineering Standards Committee, and developed in detail many suggestive proposals for the future work of the society. An abstract of this address will appear in a later issue.

The Board of Direction reported a net increase in membership, for the year, of 343, not nearly as large as in some previous years, largely due to the greater number of losses by death, 109. The deaths of men in war service amounted to 18. The total membership on Jan. 1, 1919, was 8933. Three new committees were announced during the year: (1) The Committee on Development, consisting of one member appointed by each of the 22 local associations, and seven members at large appointed by the president; (2) The New York Meetings Committee, with authority to arrange for the second meeting in each month; (3) a committee of the Board of Direction appointed to keep it informed of any Governmental or other programs looking to reconstruction or rehabilitation of the engineering resources of the country after the war.

On Aug. 1 the 57th St. society house was leased to the Ajax Rubber Tire Corporation for 10 years, at a total annual rental of about $22,750. The present mortgage on the building being $200,000, at 6% per annum, the total net revenue will be a little less than $11,000 per year.

The year has been a difficult one financially for the society. If all bills incurred during 1918 had had to be paid by Dec. 31 the books would have shown a deficit of more than $20,000. The present financial condition is the result of several factors. A general estimate of the additional burden due to the unexpected conditions shows a total of $98,000.

The Committee on Award of Prizes reported the following awards: The Norman Medal to L. R. Jorgensen for

his paper, "Multiple-Arch Dams in Rush Creek, California"; the James R. Croes Medal to Israel V. Werbin for his paper, "Tunnel Work on Sections 8, 9, 10 and 11, Broadway-Lexington Ave. Subway, New York City"; the Thomas Fitch Rowland prize to F. W. Scheidenhelm for his paper, "The Reconstruction of the Stony River Dam"; the James Laurie prize to Charles W. Staniford, for his paper, "Unusual Cofferdam for 1000-Ft. Pier, New York City"; and the Collingwood prize for juniors to James B. Hays for his paper, "Designing an Earth Dam Having a Gravel Foundation With the Results Obtained in Tests on a Model."

The Nominating Committee for the coming year was elected as follows: District 1, J. J. Yates; District 3, F. P. Williams; District 5, J. F. Conway; District 6, N. F. Sprague; District 10, F. E. Weymouth; District 11, W. Fay Barnard, and District 13, H. L. Haehl.

The Special Committee on Engineering Education reported that after 12 years of work its final report was ready in the form of Dr. Mann's exhaustive studies, undertaken with the aid of the Carnegie Foundation (see *Engineering News-Record* of Oct. 24, p. 782). After sketching the history of technical education, Desmond FitzGerald moved that the president appoint a committee of three to confer with the committee of other societies to insure careful and general discussion of Dr. Mann's report. This resolution was referred to the Board of Direction and the special committee was discharged with thanks. Reports from other special committees showing the disruption caused by the war and the fact that little progress had been made were received.

The preliminary report of the Commitee on Development, printed in the December *Proceedings*, was accepted without discussion as a progress report.

It was announced that the Board of Direction had passed a resolution on the previous day, stating that it had considered the resolution passed by the Brooklyn Engineers' Club in regard to the summary dismissal of about 350 engineer employees of the Public Service Commission, First District, of New York State, and resolving that the dismissal of these employees was not only eminently unjust and an offense to the engineering profession, but directly opposed to the best interests of the City of New York and therefore to those of the country. It also resolved that the board recognize this to be matter upon which the Engineering Council has properly taken prompt action in calling a hearing of those directly concerned, which took place the same afternoon. It was moved and unanimously carried that the action of the board be approved by the meeting.

The following resolution was then offered by R. S. Buck:

"Whereas, it is vital to the peace and welfare of our country that during the necessary reconstruction period the number of unemployed be reduced; and whereas, the development of transportation, sanitation, power, and public utilities generally is necessary to the development and prosperity of the country; and whereas, the curtailment of needed public works during the period of the war has retarded the development of the country; and whereas, the speediest and most effective means to prevent the suffering, distress and demoralization resulting from unemployment is afforded by public works; and whereas, the public welfare and confidence upon which industry generally depends require that the construction of public works be vigorously prosecuted:

"Therefore, be it resolved that the American Society of Civil Engineers desires to record its profound conviction that public works should be carried forward to the fullest extent consistent with sound judgment, not only for fundamental economic reasons but for humanitarian reasons, to furnish employment for all who are properly entitled thereto, including our returning soldiers; and it is further

"Resolved, that copies of this resolution be forwarded to such Federal, state and municipal authorities as may be able, in the opinion of the Board of Direction, to promote the purposes of the resolution."

Marshall O. Leighton discussed the work of the National Service Committee, recently organized in Washington along the lines of the tentative plan offered by Philip N. Moore in the December *Proceedings*. As chairman of the committee, he asked for help and suggestions from members of the society. The office has been established in a small way in the McLoughlin Building, Washington, and the work is now being financed by the residue of the appropriation made to the Engineering Council last year. A resolution offered by Paul Hansell that it was the sense of the meeting that the four Founder societies should join in asking their members for a subscription of $5 each, to be handled as best seemed fit by the Engineering Council, was laid on the table.

The election of officers was announced, as follows:

President, Fayette Samuel Curtis, Boston; vice-presidents, to serve two years, Herbert Samuel Crocker, Denver, and Leonard Metcalf, Boston; for treasurer, to serve one year, Arthur Smith Tuttle, New York City; for directors, to serve three years, George Hallett Clark, New York City; Jacob Stinman Langthorn, New York City; Charles Clement Elwell, New Haven, Conn.; Willard Beahan, Cleveland; John Watson Alvord, Chicago, and Carl Ewald Grunsky, San Francisco.

At the afternoon meeting Brig.-Gen. R. C. Marshall, Jr., chief of the Construction Division, U. S. A., described in detail the work done in this country during the war.

Labor Department To Study Building Conditions

Division Organized To Collect Data To Be Used In Furthering Construction Campaign

(*Washington Correspondence*)

Preparatory to launching a campaign to encourage the resumption of all kinds of construction, the United States Department of Labor has organized a new bureau, called the Division of Public Works and Construction Development. The division, which is being directed by F. T. Miller under Roger W. Babson, chief of the Education Service, has employed the services of trained political economists and specialists in various fields of business, for the purpose of collecting and compiling definite information for use in furthering the nation-wide campaign for immediate general construction. The research work is being carried on under the general supervision of Dr. E. J. Clapp, professor of economics, New York University, and Dr. M. A. Mikkelson, editor of the *Architectural Record*.

CONSULTING BOARD WILL WEIGH DATA

The research work includes the gathering of all data relating to construction, and the information so gathered and classified is to be submitted to a consulting board composed of representative business men with practical experience, who will weigh the facts and decide upon the merits and possibilities of such plans for construction as may be contemplated. The result is then furnished to those interested, through the publicity channels which have been adopted by the division.

The personnel of the Economists and Experts Branch has been carefully chosen to assure each specific field interested in construction being touched upon in the statistical estimates. Aiding Dr. Clapp and Dr. Mikkelson are Dr. Rufus S. Tucker, of Michigan University, and Dr. John Whyte, loaned by the New York University, who are engaged in land values research; Capt. Thomas W. Holden, instructor, Massachusetts School of Technology, investigating materials; Everett Domminick, New York City, in a consulting capacity, reporting on capital; E. L. Keesler, president of the League of Building and Loan Associations, in an advisory capacity; D. Everett Waide, Metropolitan Life Insurance Company, advisory; William M. Garland, president of the National Association of Real Estate Boards; E. J. Russell, director of the St. Louis Chamber of Commerce, estimating the demand for construction; A. P. Norton, statistician, Labor Department, statistics; Miss H. M. Sullivan, Chicago University, in charge of foreign precedent; Miss A. E. Hathaway, legal adviser; William B. King, of the National Federation of Construction Industries, and others who are lending their services to the work.

Specifically, the research branch has been asked to furnish all possible in-

formation as to the available supply of capital, the value of land, the cost of material, the supply of the various materials on hand, as well as the plant capacity for the production of these materials; labor, its supply, its efficiency and its cost; building construction now contemplated and held up during the war, and the demand for various classes of building in various sections of the country.

In connection with these, the economists and experts are amassing such other information as is brought to the notice of the division from time to time and which will aid in furnishing facts for publicity. This publicity will be handled through the newspaper press, the trade journals, correspondence and a speakers' bureau, the latter composed of men who have a thorough knowledge of the construction situation; they will work in cooperation with the chambers of commerce and other organizations.

To Promote Home Building

A poster campaign will be inaugurated to further the "Own-a-Home" campaign. These posters will be distributed throughout the country for display on new buildings, their purpose being to effect a closer feeling between workmen and contractors and to promote the home-building idea generally. The posters will be signed by Secretary of Labor Wilson.

In speaking of the financial plan contemplated by the division, F. T. Miller, in an interview with the Washington representative of *Engineering News-Record*, said that the logical means for bringing the construction campaign to an immediate working basis was through the building and loan associations. Mr. Miller stated that there were 7269 such associations in the United States, with a total membership of 3,838,612. Their total assets, he said, were $1,750,000,000, and their receipts for 1917 were $1,220,000,000. The cost of doing business, he pointed out, was $9,800,000, which amounted to only 0.8 per cent.

"What is necessary," Mr. Miller said, "to make it possible for these associations to aid in the Own-a-Home construction campaign, is to make their assets negotiable. If this can be accomplished—and I see no reason why it cannot—the financial problem has to a great extent been overcome."

Mr. Miller stated that he had no doubt as to the possibility of creating a demand for municipal bonds. These, he said, always have been, and are now, in demand.

The division is now sending out questionnaires to 15,000 contractors who have been compelled to discontinue building operations because of war conditions, requesting that they furnish information as to why the construction is not being completed.

Specific answers are requested relating to the cost of labor and material, and financial plans.

Walker D. Hines Is Made Director General of Railroads

The appointment of Walker D. Hines as Director General of Railroads to succeed W. G. McAdoo, resigned, was announced Jan. 11. Mr. Hines was graduated from Ogden College, and obtained the degree of LL.B. from the University of Virginia. Shortly thereafter he entered the railroad field as assistant attorney for the Louisville & Nashville R.R., at Louisville. He specialized in the study of interstate commerce laws, and in 1900 was appointed first vice president of the road. He left the Louisville & Nashville four years later and formed a law partnership with Alexander Humphrey. In 1906 he went to New York and was made counsel for the Atchison, Topeka & Santa Fé Ry. Soon thereafter he became chairman of the board of directors of the company, and later chairman of the finance committee.

When this country entered the war he resigned his offices with the railroad and went to Washington, where he became Assistant Director General of Railroads. He has been generally regarded by railroad men as Mr. McAdoo's right-hand man. Mr. Hines has definitely announced that he favors the continuation of Federal control of the carriers for a five-year period.

Work of Valuation Bureau Reported by Interstate Commission

Although the war interfered with the prosecution of the work of the Engineering Section of the Bureau of Valuation, the Interstate Commerce Commission reports that it still hopes to complete the field work in 1919. In fact, for the past year—up to Sept. 30, 1918—the road and track parties covered 53,244 miles of main track and 81,470 miles of all track, which is in excess of any previous year's record.

In view of the experience of the current year, the office work probably cannot be finished, as estimated, during 1920. It was more difficult to maintain that force, many more than 25 per cent. of the office employees in a given district changing during a single month.

While the land section has not seriously felt the effect of the war, it cannot produce completed reports until certain information is received from the carriers as to their land; inability to obtain this has limited the progress of this section. It is expected that this section will complete its work within 1920.

The greatest difficulty has been experienced by the Accounting Section in obtaining and retaining competent accountants, owing to demands for this kind of service, both by the Government and by private enterprises. It is difficult to find men competent to put the needed information into the form of completed reports. The field work of this section should be finished in the first part of 1920.

On the whole, it is believed that while the war has seriously affected this work, it will not greatly postpone the period of final completion nor increase the total expense.

Would Appropriate $100,000,000 for Land Reclamation

Expenditure of $100,000,000 by the Secretary of the Interior "for the investigation, irrigation, drainage, and development of swamp, arid, waste, and undeveloped lands," to provide "employment and farms with improvements and equipment for honorably discharged soldiers, sailors, and marines of the United States," is authorized by a bill now before Congress. The lands reclaimed would be so disposed of by the Secretary of the Interior as to reimburse the United States within 40 years from entrance by settlers, with interest at 4%. The money will be available to develop one or more projects in each state, if feasible projects can be found. The scheme is in line with recommendations made by Secretary Lane. Investigations of the kind contemplated are already being made by the United States Reclamation Service.

American Engineer Elected to L'Institut de France

J. A. L. Waddell, consulting engineer of New York and Kansas City, was elected, Dec. 17, to L'Institut de France as a corresponding member in the Académie des Sciences. L'Institut de France is composed of five academies, including the Académie des Sciences, which is restricted to a full membership of 66, all of whom must be citizens of France, and in addition there are 116 corresponding members in other countries. The académie is divided into several sections, including geometry, mechanics, astronomy, geography and navigation, and general physics. Dr. Waddell's election to the mechanical section fills the vacancy created by the death of General Zaboudski of Petrograd.

Fayette S. Curtis

(*Concluded from page* 160)

gineering work being done by the company at that time between New Haven and New York, it was necessary for him to assume personal charge, and in 1904 he moved his headquarters to New Haven. He served as vice president of the New Haven until April, 1907, when he was appointed president of the Old Colony R.R. Co. and the Union Freight R.R. Co. of Boston. Since that time his headquarters have been in Boston.

Some of Mr. Curtis' works, aside from those already mentioned, were the large drawbridge over Fort Point Channel, Boston; the South Terminal Station, Boston, of which he was consulting engineer, and double-tracking and grade-crossing improvement work on many sections of the New Haven.

Railroad Executives Favor a Department of Transportation

At a meeting held in Philadelphia Jan. 5 the Association of Railway Executives unanimously adopted a plan calling for the creation of a Department of Transportation, headed by a Secretary of Transportation, who would be a cabinet officer and to whom would be transferred the administrative functions now performed by the Interstate Commerce Commission. Among other principles for an elaborate revision of existing railroad control legislation, the plan includes the following:

Private ownership, management and operation should, as a matter of national policy, be continued.

The power of regulation, including all rates, state or interstate, should be exclusively in the hands of the national Government, but administered through machinery or agencies responsive to the needs of and convenient to the people of the several states.

The carriers should have the power to initiate rates.

The statute should provide the rule of ratemaking, and should require that rates be not only what has been called reasonable but adequate and sufficient. Rates, whether approved or disapproved by the Secretary of Transportation, may by complaint be brought before the Interstate Commerce Commission, which should have power to pass upon the reasonableness and adequacy thereof.

The Interstate Commerce Commission should have power to prescribe minimum rates as well as maximum rates.

Other provisions are submitted covering in detail the questions of rates and the required modification of the Clayton act, the control of securities and a system of Federal incorporation. Thomas DeWitt Cuyler is chairman of the standing committee of the railroad executives.

Honor Resident Engineer of Army Supply Base at Boston

A dinner was given in honor of George L. Mirick, resident engineer of the Boston Army Supply Base, at Young's Hotel in Boston, Jan. 3, by the engineering staff of Fay, Spofford & Thorndike, consulting engineers, Boston, in recognition of his services on the work. Among those who attended were John Ayer, executive engineer of the supply base; Warren D. Trask, assistant division engineer attached to the field office; Capt. George D. Emerson, Quartermaster Corps, who was in charge of inspection; Carroll A. Farwell, division engineer in charge of substructure design; Bion A. Bowman, division engineer in charge of superstructure design, and Barzillai A. Rich, division engineer in charge of equipment.

The dinner was followed by expressions of appreciation of Mr. Mirick's work as resident engineer.

Engineering Council Holds Hearing on Public Service Engineers' Dismissal

Facts as to Crippling of Rapid-Transit Work Presented—Delegate Protests On Score of Workers' Safety—Mass Meeting Asked

A hearing on the mass dismissal of engineers of the Public Service Commission of New York State, First District, was held Jan. 14 by a committee of the Engineering Council at the Engineering Societies Building, New York. Commissioner Travis H. Whitney, representing the commission, which had been invited to the hearing, stated the situation. More details of how the work of design, construction and supervision is affected were given by Robert Ridgway, acting chief engineer; A. I. Raisman, engineer of design; C. M. Holland, tunnel engineer, and C. F. Smollin, chief clerk. The Board of Estimate, which had also been invited, was not represented.

Figures on the depletion of various branches of the engineering organization were given—the total engineering force of 812 being reduced by 334—and it was stated that in view of the serious responsibilities involved it had been concluded that the only possible course is to concentrate the available men on the contract sections most urgently in need of being carried on. This necessitates stopping work on the other sections. Questions of the committee developed the fact that this procedure will inevitably subject the city to direct losses as well as to contractors' claims of damage for delay. At present contracts amounting to about $80,000,000 are outstanding, on which $60,000,000 has been paid; the latter sum therefore represents capital lying idle in case work is delayed.

Work has had to be stopped on the preparation of designs for a large number of important contracts planned to be let during the coming season, such as the Nassau St. line and the Steinway tunnel extension. Approval of working drawings on present contracts has also been interrupted. The chief design divisions have been cut to one-third or less of their necessary minimum complement.

The committee displayed interest in the statement that the conduct of the river tunnel work and certain other operations represented a grave situation in view of the reduction in engineering force. It then concerned itself particularly with the question whether the cut in appropriation and the fixing of a detailed schedule of positions and salaries had been preceded by hearings, or by conferences between the commission and the board. Commissioner Whitney stated that no hearings or conferences had taken place.

It appeared that the action taken was based on little or no knowledge of the requirements of the rapid-transit work, and that the schedule, which ignores civil service laws and contains many faults and inconsistencies, was prepared by a subordinate of the Board of Estimate of the city and had not been scrutinized by the board.

A strong statement was made by M. McConville, a delegate from the Hoisting Engineers' Union, who asserted that the workers' safety depended on engineering supervision and protested against the reduction of the engineering force by the board.

Resolutions of protest passed by the Brooklyn Engineers' Club, by the American Society of Civil Engineers, and by the Municipal Engineers of New York, were read to the committee by representatives. The General Contractors' Association, the Merchants' Association and the Chamber of Commerce were represented.

J. C. Meem, speaking from the viewpoint of the contractors, forcibly expressed their sympathy with the protest against crippling the engineering supervision of public work.

In opening the hearing, H. W. Buck referred to the development of engineering public opinion in recent years as a new force, and said that the hearing was a step in bringing that opinion to bear on the case in hand.

A plea for more emphatic and representative development of the profession's public opinion was made by E. J. Mehren, editor of *Engineering News-Record*, at the close of the proceedings. He urged the value of a mass meeting of New York engineers, to be called by the council, if the facts developed at the hearing appeared to justify further action.

Seattle To Buy Street Railways

Municipal ownership of the street railways of Seattle, through purchase from the Puget Sound Traction, Light & Power Co. for $15,000,000 of city bonds, is authorized by an ordinance passed by a 5 to 2 vote of the city council Dec. 31. The property includes 203 miles of track and 540 cars, besides carhouses, repair shops and supplies. A referendum vote on the purchase is a possibility but is not expected, for in November last the general plan was approved 4 to 1 on an "advisory" popular ballot. The city and company officials have agreed on a friendly suit to determine the legality of the transaction. It is hoped that the property will be transferred to the city by Mar. 1.

Mining and Electrical Engineers to Hold Joint Meeting

It is planned to hold, at the annual meeting of the American Institute of Mining Engineers, in New York, Feb. 17-20, two joint sessions with the Canadian Mining Institute Feb. 18, and one joint session on the afternoon of Feb. 19 with the American Institute of Electrical Engineers.

Would Give Supply Men More Recognition

Changes in New England Water-Works Association Customs Suggested by President Davis

More recognition of both the younger and the associate members of the New England Water-Works Association was suggested by Carleton E. Davis, retiring president, in his address at the annual meeting of the Association in Boston, Jan. 8. Before reaching this part of his subject Mr. Davis touched on services rendered by water-works during the war and the opportunities for still further service during the reconstruction period. In closing, reference was made to the annual award of the Brackett memorial. A condensation of the address follows:

"Water-works officials may feel legitimate pride that the utilities under their direction responded generally to the public necessities of the war period in a satisfactory way. Probably no other essential to the prosecution of the war suffered fewer breakdowns and caused less concern to the consumer than did the water-works, notwithstanding that they, equally with other public-function activities, were handicapped by the general difficulties of the situation. The period of reconstruction has now come. Out of the present situation will come whatever those who are able to form and direct may desire.

"The association will grow according to the service it renders. There is an opening for a new field of usefulness in the development of the headquarters force, so that any person anywhere desiring information on water-works subjects would think naturally of the New England Water-Works Association as the source to which to apply. Such service would bring returns in increased membership, wider circulation of the *Journal* and greater advertising value for its pages.

Younger Men Should Come to Front

"Perhaps the younger members are not heard from as frequently as desirable. There is a natural gravitation of one age to a like age, and it may be that there has been an undue representation in the management of the association of the members of maturer years who may lack the necessary acquaintance among the younger men to bring out all their possibilities.

"The old-fashioned experience meetings are typical of the spirit of this association. They were good for the soul and good for the mind, and personally I hope it will be found proper to develop an increase in their number. They have been the means of placing at the disposal of the general water-works practitioner a vast fund of invaluable information concerning ways and means, and at the same time they have furnished a wonderful safety valve for pent-up feelings.

"Possibly the future may develop periodical meetings conducted by the associate members—meetings at which the present practice will be reversed and the associates will talk while the members listen. It may be that the associates are now obtaining an undue advantage in listening to the views of the members, pro and con, without being obliged to commit themselves to any line of action. On the other hand, perhaps the members are not availing themselves of an opportunity to hear a frank discussion between the various makers of the articles in everyday use by the water-works operator. Nothing could be more enlightening than a free discussion between makers of competitive goods, and doubtless such discussions could be brought about without detriment to any and with profit to all, apart from the features that may savor of competition. This same principle might be carried further with advantage and membership on committees investigating subjects in which the associates are vitally interested might be given them.

Half of Income from Associates

"One change which has already been effected by the war is open diplomacy and the adoption of perfect frankness and discussion. In following these lines, the association will doubtless reconstruct the present rather indefinite financial status of the associates. From dues and through advertising, the association derives about one-half of its income from the associates, and at the conventions accepts or solicits contributions for entertainments and hospitality. This is not solely a business transaction on either side. The association furnishes a medium through which personal relations are developed, to the mutual advantage of both parties having business to transact with each other. The situation should be frankly recognized and put on a definitely understood basis.

"A notable recognition of the wide range of activities embraced within the membership of this association is the award of the Brackett memorial for a paper devoted to accounting. The water-works operator has been too often classified as a specialist on pumps, pipes, reservoirs or some similar matter, while in fact he is responsible for not only the operation of highly specialized machinery, but he is further charged with the conduct of large business interests. By its own action, the association now lays claim to this larger sphere of operations and asserts the proper standing of its members in the community."

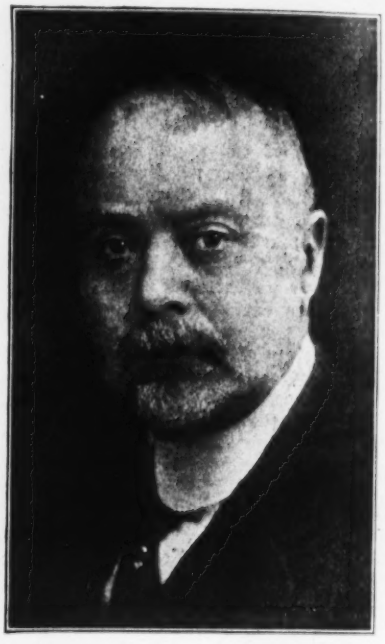
Business Proceedings

The canvass of ballots showed the election as president of Samuel E. Killam, superintendent of pipe lines and reservoirs, Metropolitan Water-Works, Boston, and the reëlection of the following: Secretary, Willard Kent, Narragansett Pier, R. I.; editor, Henry A. Symonds, consulting engineer, 70 Kilby St., Boston; treasurer, L. M. Bancroft, Reading, Mass.

Hermann Laub

Hermann Laub's death from heart failure on Dec. 10 took away an unusually able and versatile engineer. He ranked among the best bridge engineers in the country.

As builder of two important suspension bridges over the Ohio River, at East Liverpool, Ohio (1896), and Parkersburg, W. Va. (1916), Mr. Laub had achieved the rank of leading



HERMANN LAUB, 1855-1918

authority on medium-span suspension bridges. Disagreeing with current teachings and practices, he held strong convictions of the merit of the suspension type for heavy street service, and through this conviction accomplished a distinct revival of the medium-span suspension bridge. He showed corresponding independence and vigor of thought in other fields.

Born Apr. 14, 1855, at Durmentingen, Württemberg, of Swiss ancestry, Hermann Laub studied civil engineering at the Stuttgart Polytechnic (1875) and the Munich Technical College (1870) and then removed to the United States. His engineering career in this country began in 1880, on the Denver & Rio Grande. For half a dozen years he was associated with Gustav Lindenthal in engineering practice. In 1890 he established an independent practice in Pittsburgh.

His structures include many notable works. Tasks of exceptional difficulty were often entrusted to him. An example was the salvaging and repair of the 22nd St. bridge over the Monongahela River at Pittsburgh in 1910.

A year or more ago Mr. Laub undertook to set down his views and experiences in the field of suspension bridges. This work remained unfinished at the time of his death.

F. E. S.

Engineer Officers Decorated With Distinguished Service Cross for Services Rendered in This Country

MAJOR GENERAL GEORGE W. GOETHALS

MAJOR GENERAL WILLIAM M. BLACK

BRIGADIER GENERAL HENRY JERVEY

Cleveland Votes to Build New Union Station

By a vote of 31,000 to 20,000 approximately, the City of Cleveland on Jan. 6 adopted the ordinance authorizing the mayor to enter into a contract with the Cleveland Union Terminal Co. providing for the construction, maintenance and operation for the use of steam and electric railways of a union passenger depot adjoining the southwest corner of the Public Square. This contract when signed would, at the option of the railways concerned, serve to abrogate the previously signed contract between the city and the Pennsylvania, New York Central, Cleveland & Pittsburgh and Big Four Railroads for a union station on the lake front. The lake-front station plan was developed subsequent to the adoption of the Cleveland group plan, which provides for a Mall reaching from the lake front south to a point just east of the Public Square and lined on each side with public buildings. This building plan has already been started, and a number of public buildings are in place. The railroad station, however, has never gone beyond the project stage, the contract providing that work should start within six months after the delivery of certain deeds, which real estate deal has never been consummated.

The new union station scheme developed from a project to build a station for the Cleveland & Youngstown R.R., into which were later drawn the Wheeling & Lake Erie, the Erie, the B. & O., and the Nickel Plate, which latter had bought the Cleveland & Youngstown Railroad. The latter station was originally planned as a stub-end terminal lying south and west of the Public Square along the Cuyahoga River valley, and embraced freight terminals farther south along the same valley. When plans for this passenger station were submitted early in 1918 to the United States Railroad Administration it was suggested by the Regional Director that the plan be changed from a stub-end to a through-passenger station, with interurban electric terminal facilities, and that all the railroads entering the city be brought into the scheme. Later in 1918 the various railroads concerned came to an agreement to this end, and a report recommending a grand union station for all the railroads was adopted. This report brought about the introduction of the ordinance which has just been voted upon.

Although most optimistic newspaper reports come out of Cleveland to the effect that the new station will be immediately started, in fact there remain a number of difficulties, partly financial and partly legal, which have to be overcome before actual construction will be started.

A number of technical reports were made on the general feasibility of the new scheme and the desirability of one of the two schemes.

Nominations for American Railway Engineering Association

The nominating committee of the American Railway Engineering Association announces the following nominations of candidates for officers for the ensuing year:

For president, Earl Stimson, general superintendent maintenance of way and structures, Baltimore & Ohio Railroad; for vice president, J. A. Atwood, chief engineer, Pittsbugh & Lake Erie Railroad; for treasurer, George H. Bremner, district engineer, Bureau of Valuation, Interstate Commerce Commission, Chicago; for secretary, E. H. Fritch, Chicago.

Response to Inquiry Indicates Extensive Road Building

Road building will be undertaken on an extensive scale during the coming season, furnishing a large amount of work for returning soldiers, according to information obtained by the Bureau of Public Roads in response to an inquiry sent to the various state highway departments. Of the 38 states replying to the questionnaire, 29 gave definite figures. A summary of their reports shows that they can utilize 11,637 soldiers and sailors, as skilled laborers, and 91,904 as unskilled laborers. The bureau estimates that the total amount of road work in the United States for the coming year will be about $300,000,000.

In making its reports on road conditions to the newly formed Division of Public Works and Construction Development of the Department of Labor, the Department of Agriculture gave detailed reports from 20 states showing that $120,000,000 will be expended on road work which has definitely been decided upon. It is estimated that 50% of this amount will go to labor.

In commenting on these conditions, the Department of Labor urges that public works unquestionably needed should be put under way at once.

ENGINEERING SOCIETIES

The Montreal Branch of the Engineering Institute of Canada was addressed Jan. 9 by George H. Greenfield, of the National Fire Protection Association, who spoke on "Fire Prevention."

Calendar

Annual Meetings

AMERICAN WOOD PRESERVERS' ASSOCIATION; F. J. Angier, Mt. Royal Station, Baltimore, Md.; Jan. 28-29, St. Louis.

AMERICAN ROAD BUILDERS' ASSOCIATION; 150 Nassau St., New York City; Feb. 25-28, New York City.

NATIONAL RIVERS AND HARBORS CONGRESS; 824 Colorado Bldg., Washington, D. C.; Feb. 5-7, Washington, D. C.

AMERICAN INSTITUTE OF MINING ENGINEERS; 29 West 39th St., New York City; Feb. 17-20, New York.

The Indiana Engineering Society, at the annual meeting to be held in Indianapolis, Jan. 23-25, noted in these columns last week, will give prominence to the general subject of the status of the engineer and the organization of engineering societies. Included in the list of subjects and speakers are the following: "The Engineer, His Problems and Opportunities," by W. H. Finley, president of the Chicago & Northwestern Railway Co., and president of the American Association of Engineers; "The Need of Coöperation Among Engineers," by C. E. Drayer, secretary of the American Association of Engineers; "Proposed Bill for Licensing Structural Engineers," by H. O. Garman and W. H. Insley, Indianapolis; "Developments of the Governing Policies for Engineering Societies," by Prof. A. N. Talbot, retiring president of the American Society of Civil Engineers. Highway and railroad problems are included in the topics for discussion.

The Detroit Engineering Society held a meeting Jan. 10 devoted to the subject of "Grade Separation." The meeting was addressed by Prof. Henry E. Riggs, of the civil engineering department, University of Michigan, and John W. Reid, grade-separation engineer for the city of Detroit. The society will hold a meeting Jan. 24, to be devoted to the subject "Artillery in War." The meeting will be addressed by an officer of the Ordnance Department of the Army.

The Engineers' Club of Philadelphia will be addressed by Lieut. Col. E. B. Morden, U. S. A., Constructing Quartermaster, Philadelphia, on "The Construction Division of the Army," at the weekly luncheon of the club, to be held Jan. 21.

The Rochester Engineering Society will hold a meeting Jan. 17, with "Old Surveys of Rochester" as the subject of discussion. This is to be the first in a series of group meetings on the subject of municipal surveys.

The Engineers' Club of St. Louis has elected officers for 1919 as follows: President, Baxter L. Brown; vice-presidents, George R. Wadleigh, W. E. Wolfe and H. W. Eales; treasurer, C. W. Martin; directors, George E. Chamberlin, J. L. Hamilton and W. W. Horner. J. W. Kerr is secretary.

The Engineers' Club of Trenton was addressed, Jan. 9, by Lieut. Col. George A. Johnson, Construction Division, U. S. A., who spoke on "The Operation of Army Camp Utilities by the Construction Division of the Army."

The Florida Engineering Society held its annual meeting at Jacksonville Jan. 6. In presenting the report of the Committee on Harbor Improvements, W. W. Fineren, United States junior engineer, United States Engineer's Office, Jacksonville, emphasized the need of municipalities taking a more active interest in developing the harbor facilities of Florida, and indicated many possibilities for expansion. In the report of the president of the society, emphasis was given to the lack of recognition for engineering service, including a statement that although engineers, by training and experience, are fitted for civic duties, they have in the past been seldom appointed to civic boards and commissions. The following officers were elected: President, B. Johnson, Miami; vice-president, G. B. Hills, Jacksonville, and secretary, J. R. Benton, Gainesville.

The Gas Engineering Section of the Western Society of Engineers was addressed by Prof. S. W. Parr, department of applied chemistry, University of Illinois, on "The Present and Prospective Status of the Gas Industry," at the first meeting of the section since its formation. The meeting was held Jan. 8. This section is one of the few strictly professional gas engineering organizations, and a campaign is being conducted to bring into the society additional membership among gas engineers.

PERSONAL NOTES

LEWIS NIXON, consulting engineer, New York City, has been appointed Superintendent of Public Works of New York State. Mr. Nixon was previously consulting engineer and acting commissioner of public works of the Borough of Richmond, New York City, resigning in 1915 to enter private practice. He was graduated from the United States Naval Academy at the head of his class in 1878 and later was sent by the Navy Department to the Royal Naval College, Greenwich, England. He was appointed naval constructor in the United States Navy in 1884. Several years later he withdrew from the Navy to become superintending constructor of the Cramp shipyard, Philadelphia. In more recent years he has been prominently connected with politics in New York State. In 1914 he became consulting engineer and acting commissioner of public works of Richmond.

G. H. DUGGAN, vice president and managing director of the Dominion Bridge Co., Montreal, has been elected president of the company.

MAJ. MYRON B. REYNOLDS, recently released from his command of the 208th Engineer Sappers, 18th Division, Camp Travis, Texas, has been appointed acting assistant city engineer of Chicago, succeeding Henry W. Clausen, who resigned Jan. 1 to enter private business, as mentioned in these columns last week. Major Reynolds was engineer of water-works design in Chicago for four years previous to his entry into Government service in September, 1917. He entered the city engineering department thirteen years ago.

HUGH RODGERS has been appointed to the position of city engineer of Salem, Ore.

RICHARD H. GILLESPIE, formerly chief engineer of the Borough of the Bronx, New York City, has been appointed chief engineer and general manager of the Dewey Cement-Gun Construction Co., with headquarters at Allentown, Penn.

CLARK DILLENBECK, engineer of bridges and buildings, Philadelphia & Reading R.R., has been appointed assistant chief engineer of the Reading, the Central Railroad of New Jersey, the New York & Long Island R.R., the Atlantic City R.R. and the Port Reading Railroad.

HOMER C. BENDER, previously of Berkeley, Cal., has been appointed superintendent of public utilities, Spokane, Wash.

R. A. BURNS has been appointed to the office of city engineer of Lewiston, Idaho.

F. O. DUFOUR, division of construction and engineering, Stone & Webster, has been appointed structural engineer, with headquarters at the main office in Boston.

MAJ. A. CLINTON KNIGHT, Corps of Engineers, U. S. A., who recently returned from overseas, has received his discharge from the service and has been appointed assistant engineer, city highway engineering department, Baltimore.

CHARLES M. WHELAN, hydraulic department, Aluminum Co. of America, Pittsburgh, has been transferred to the sales department of the company at Kansas City, Mo.

P. S. BAKER has been appointed engineer of bridges and buildings, Philadelphia & Reading R.R. and associated lines, succeeding Clark Dillenbeck, who has been appointed assistant chief engineer of the lines, as noted elsewhere in this column.

WAYNE A. PITTS, formerly vice-president of G. W. Ensign, Inc., engineer and contractors, Harrisburg, Penn., has resigned to become plant

engineer for the York Haven Paper Co., York Haven, Penn.

MAJ. D. L. HOUGH, Construction Division, U. S. A., has received his discharge from the service and returned to his office at 17 West 42nd St., New York City. He has spent the greater part of the last seven years in Russia, returning to this country in October, 1917, when he applied for a commission in the Corps of Engineers. He served in the office of General Goethals in Washington until April, 1918, when he was commissioned with the rank of major in the Construction Division, and was later assigned to special duty at the port of embarkation, Hoboken, N. J., as Army representative on the Longshoremen's War Committee.

B. M. ATWOOD has resigned as state engineer of Arizona. It is understood that Mr. Atwood will enter the contracting business, specializing in highway construction.

CAPT. A. D. BUTLER, Corps of Engineers, U. S. A., returned recently to his duties as city engineer of Spokane, Wash. Captain Butler left Spokane in October, and was assigned to the construction of the Army warehouse at Schenectady, N. Y.

C. N. PERRY, assistant chief engineer of the Imperial Irrigation District, El Centro, Cal., has been appointed acting chief engineer and general manager, succeeding C. K. Clarke.

F. M. HAWTHORNE, assistant engineer, Pittsburgh, Cincinnati, Chicago & St. Louis Ry., with office in Terre Haute, Ind., is now assistant division engineer, Pennsylvania R.R., with headquarters in Pittsburgh.

F. L. DORE, chief draftsman, office of chief engineer, Wabash Ry., in St. Louis, is now, by recent appointment, assistant engineer, Pittsburgh & West Virginia Ry. at Pittsburgh.

L. C. HULBURD, whose appointment as division engineer, department of the State Engineer and Surveyor, of New York, at Rochester, was mentioned in these columns last week, has been connected with the state engineering department for the past 13 years. As resident engineer, he was in charge of the construction of the barge canal water-supply reservoir at Rome and several of the canal lock terminals. Previous to entering the state engineering department he was engaged on the St. Lawrence River hydraulic power development at Massena, N. Y., and the Chattachoochee River power developments near Atlanta, Ga.

A. R. DUNN, assistant engineer, Pittsburgh, Cincinnati, Chicago & St. Louis Ry., with office in Richmond, Ind., has been transferred to Terre Haute, succeeding F. M. Hawthorne, appointed assistant division engineer, Pennsylvania R.R., at Pittsburgh, as mentioned elsewhere.

MAJ. HENRY W. WILSON, Corps of Engineers, U. S. A., who received his discharge from the service recently, is now become associated with Young, Corley & Dolan, Inc., New York City. He served for 20 months with the 302nd Engineers, 77th Division, American Expeditionary Forces. Formerly he was representative of the sales department, Barber Asphalt Paving Co., New York City.

A. E. OWEN, chief engineer of the Central R.R. of New Jersey and the New York and Long Branch R.R., has been appointed also chief engineer of the Philadelphia & Reading R.R., the Atlantic City R.R., and the Port Reading R.R., succeeding S. T. Wagner, resigned. Mr. Owen was educated at Rutgers Scientific School, and joined the staff of the engineer of Essex County, New Jersey, in 1896. Two years later he became draftsman for the Central R.R. of New Jersey. He was successively transitman, assistant engineer, and assistant to the chief engineer. In July, 1916, he was appointed principal assistant engineer, and afterwards became chief engineer.

S. E. SHOUP, assistant engineer, Kansas City Southern Ry. at Kansas City, Mo., has been appointed engineering assistant to the general manager.

F. N. HOLMQUIST, consulting engineer, Phoenix, Ariz., has been appointed state engineer of Arizona, succeeding B. M. Atwood, resigned, as mentioned elsewhere. He was graduated from the University of Illinois in 1909, and has spent the greater portion of his time in Arizona. He was city engineer of Phoenix for several years previous to entering private practice in 1914.

CAPT. LAWRENCE D. STODDART, Construction Division, U. S. A., has returned to his duties as city engineer of Trinidad, Colo.

MORTIMER FREUND, who has been in charge of the trench warfare branch, loading section of the explosives and loading division, Ordnance Department, Washington, D. C., recently received his discharge from the service and resumed his work in the firm of Eadie, Freund & Campbell, consulting engineers, New York City.

REVOE C. BRIGGS, previously of the 472nd Engineers, has returned to his former position as assistant engineer, water resources branch, United States Geological Survey, at Pasadena, Cal., following his discharge from the service.

OBITUARY

BROOKS D. HABERMAN, assistant city engineer of Marion, Ohio, died in that city Jan. 4. Previous to his entering the city engineer's office four years ago he was associated with the Marion Steam Shovel Company.

JOHN W. HORTON, for several years assistant city engineer of Sacramento, Cal., died in that city Dec. 24. He was a graduate of the University of California, and was engineer in charge of construction of the Sacramento bypass weir, which was recently completed.

MARVIN W. KINGSLEY, superintendent and chief engineer, city water-works department of Cleveland, died recently at Ripley, N. Y. He was in the service of the water-works department from 1892 to 1901, and the lake intake tunnels were constructed under his supervision. He was born in 1846 and went to Cleveland in 1873.

WILLIAM APPLETON HAVEN, retired civil engineer of Buffalo, died in that city Jan. 6 at the age of eighty-seven. His early engineering experience was in railroad work on the Wisconsin Central and the Burlington. Later he engaged in railroad construction in Vermont and in the double-tracking of the New York Central. He went to Buffalo in 1877 in charge of construction work for the Erie, Lehigh Valley and Buffalo Creek Railroads. In 1885 and 1886 he was associated with Robert Harris in the building of the Northern Pacific Railroad, and later, the Montana Central. He returned to Buffalo in 1890 and became supervising engineer for the Erie Railroad, specializing in grade crossing work. He served in the Civil War as first lieutenant in a New Hampshire volunteer regiment and later became commissary general of a Montana organization. He became a member of the American Society of Civil Engineers in 1873.

DR. WALLACE C. SABINE, professor of mathematics and natural philosophy, Harvard University, and formerly dean of the Lawrence Scientific School of Harvard, died at his home in Boston Jan. 10. He was fifty-six years of age. He was graduated from Harvard with the degree of M. A. in 1888 and became a member of the faculty in the next year. He received the degree of doctor of science from Brown University in 1907 and the same degree from Harvard in 1914. He was a member of the National Academy of Sciences. A large part of his research work was made public in articles in *Engineering Record*.

WALTER V. TURNER, manager of the engineering department, Westinghouse Air-Brake Co., died in Pittsburgh Jan. 9. He was the inventor of the type "K" quick-action air-brake triple valve, which has been a controlling factor in making possible the operation of the long freight trains. He was the inventor of many other railroad appliances. He was born in England in 1866 and received his education at the Textile Technical School, Wakefield, coming to the United States in 1888. He received the Langstreth medal in 1911 and the Elliott Cresson medal in 1912.

Digging and Backfilling With One Machine

Development of the Usual Trencher in Which the Two Operations Are Nearly Simultaneous

A machine that digs and backfills in practically a simultaneous operation has recently been produced. It is a development of the usual trench machine, a dipper bucket having been added. It works in varying material between very loose earth—in which a bucket with shovelers would be necessary—and hardpan and rock, in which blasting is required.

As indicated in the accompanying illustration, it is, in effect, a movable shovel mounted on a separate car and

NEW DIPPER TRENCH MACHINE

operated by an engine placed in a stationary car ahead of the trench. A movable anchor is placed at the opposite end of the trench, and the dipper car is moved back and forth by the same lines that do the holding and digging. With an operating crew, of two men, under ordinary conditions, the earth, dug ahead by the dipper, is carried back and used immediately as backfill. If for any reason the dipper cannot be operated, it is locked up out of the way upon the car.

On a sewer job in Stratford, Conn., during December, this machine was operated on one-half ton of coal per day with but two men; one engineman and one shovelman. During December this machine, operating in soil varying from loose material to hardpan, dug approximately 1250 lin. ft. of trench 4 ft. wide and 11 ft. deep. The contractor stated that in clay he was able to make approximately 100 ft. a day; in coarse gravel and sand, approximately 80 ft. per day, but these figures were reduced to 30 or 40 ft. per day in hardpan. An advantage of this machine, pointed out by the engineers on the job, lies in the fact that it obviates the necessity of placing the excavated material along the edges of the trench, thus reducing the weight on the bank and effecting a saving in handling and sheetpiling in the kind of work to which the machine is best adapted. The machine is manufactured by the Moore Trench Machine Co., Rockaway, N. J.

Italian Government Commission Buys American Lumber

The purchase of 3,500,000 ft. of yellow pine and timber has been made by commissioners representing the Italian Government, according to a report received from the Southern Pine Association. The timber was specified as Southern pine, merchantable grades, for delivery at Gulf ports, to be moved to Italy by ships supplied by the purchaser. The order has been distributed among the Southern pine mills east and west of the Mississippi. The product will be inspected at the mills by the Association of Inspectors and shipped to designated ports to await the cargo steamers.

The association also states that reports are current that France and England will also buy lumber in this country through the various commissions that handled war-time purchases, and the association points out that if the purchasers supply the cargo space the problem of shortage of ships will be very nearly solved for this country.

National Slag Association Elects Officers

The National Slag Association elected officers for the year 1919, and appointed an executive committee, at a meeting held Jan. 10 in Cleveland. The three officers elected are F. A. Sarstedt, C. E. Ireland, and H. J. Love, elected respectively president, vice president and secretary-treasurer, and the executive committee consists of F. A. Sarstedt, L. A. Beeghley, L. H. Hawblitz, E. H. Kuttner and C. L. McKenzie. The executive committee was authorized to act as a contact or coöperation committee with similar committees appointed by the national organizations which are supported by the sand, gravel, and stone interests in the United States.

The report states that in all about 80% of the commercialized blast furnace slag tonnage of the country is represented by this association, whose aim is the ultimate standardization of this product when used as railroad ballast, concrete aggregate, or in macadam highway construction.

French Munitions Department Now Reconstruction Ministry

The Department of Industrial Reconstruction in France has been formed from the armament (munitions) department. M. Loucheur, who has been the minister of armament, will retain the directorship of the new department, according to a recent commerce report. The ministry, it states, will be responsible for the development of industrial production of all kinds, and will distribute among the industries the orders which shall be placed by other Government departments. It will also assist in the preparation of projects relating to the increase of national production, with the object of adapting the munitions factories, created by the French Government and private companies for national defense, to the industrial period now at hand.

BUSINESS NOTES

The Independent Pneumatic Tool Co., Chicago, Ill., announces the opening of a branch office and service station at 1103 Citizens Building, Cleveland, Ohio.

The Lake Shore Shale Brick Co., Ashtabula, Ohio, has been merged with the Burton Townsend Co., Zanesville, Ohio, and the new company will be known as the Burton Townsend Co. The capital stock, it is said, will be $3,500,000.

P. E. Francis, who has in the past conducted a railroad and industrial equipment business under the name of and in conjunction with Edward Jobbins, has severed his connections with Mr. Jobbins, and his business in the future will be conducted under the name of P. E. Francis & Co., Marquette Building, Chicago, Ill.

The United States Cement Tile Co. is a recently organized corporation, with $100,000 capital. The officers are Matthew Gunton, president; E. F. Norris, secretary and treasury; G. R. Mueller, general manager; W. H. Ault, superintendent.

TRADE PUBLICATIONS

Electric tractors and industrial trucks for use in freight houses, warehouses and manufacturing plants are the subject of four 6 x 9-in. bulletins of four and eight pages issued by the Buda Co., Chicago. The tractors have three wheels and are used exclusively to haul trailer trains. The trucks are designed to carry removable platforms which can be set on the floor for loading at any convenient place, and picking up later by the truck.

The Lidgerwood Manufacturing Co. has issued a 9 x 12-in. 32-page catalogue, bulletin of 1918, illustrating and describing its line of steam mine hoists.

A. S. Cameron Steam Pump Works, 11 Broadway, New York, have issued a 12-p. bulletin on pumps for marine service. This bulletin shows sectional and complete views, as well as description and tables, that will be of service to anyone interested in the subject of marine pumps.

The Hunting Davis Co. has issued a 6 x 7½-in. pamphlet illustrating various structures built by the company.